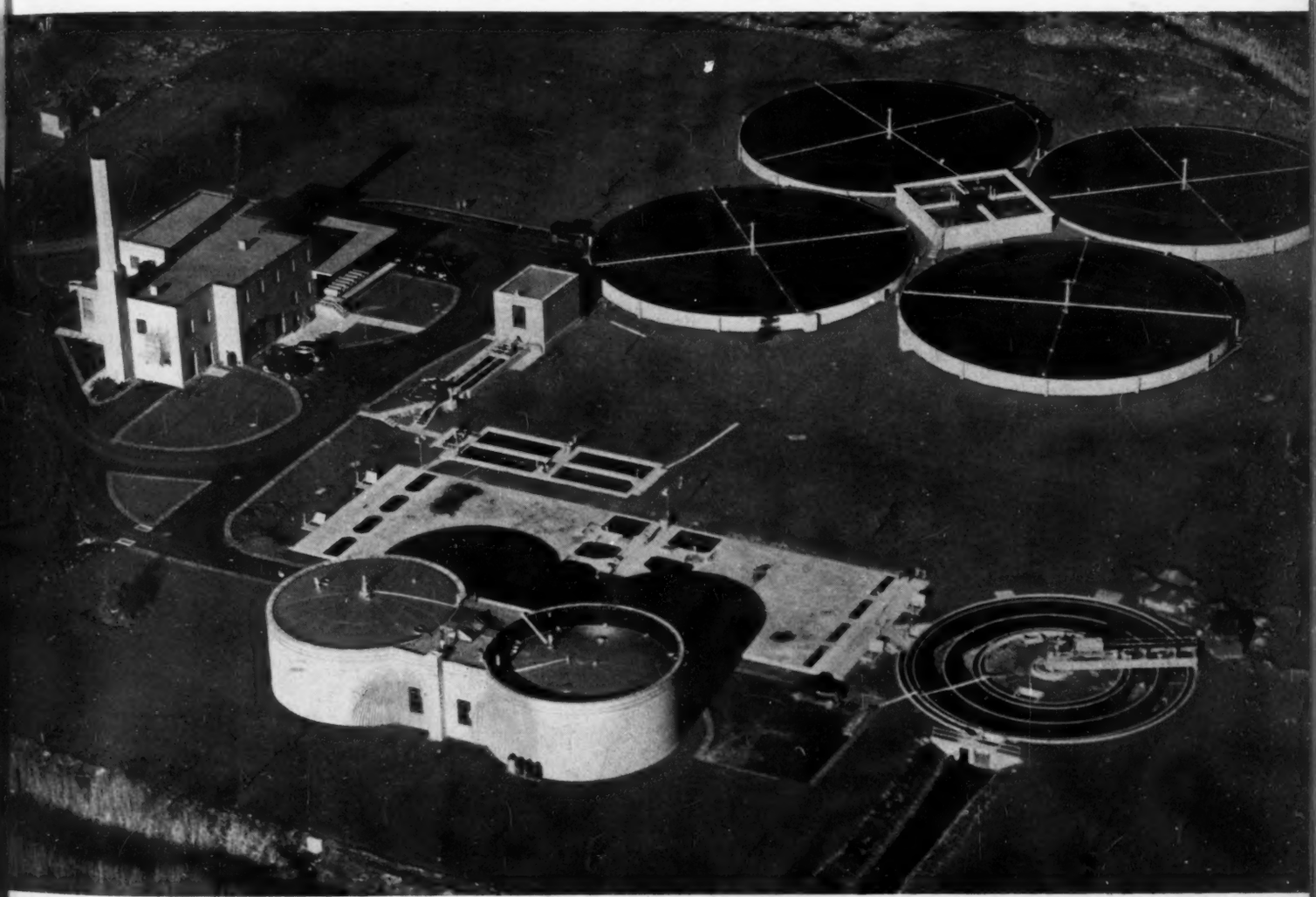
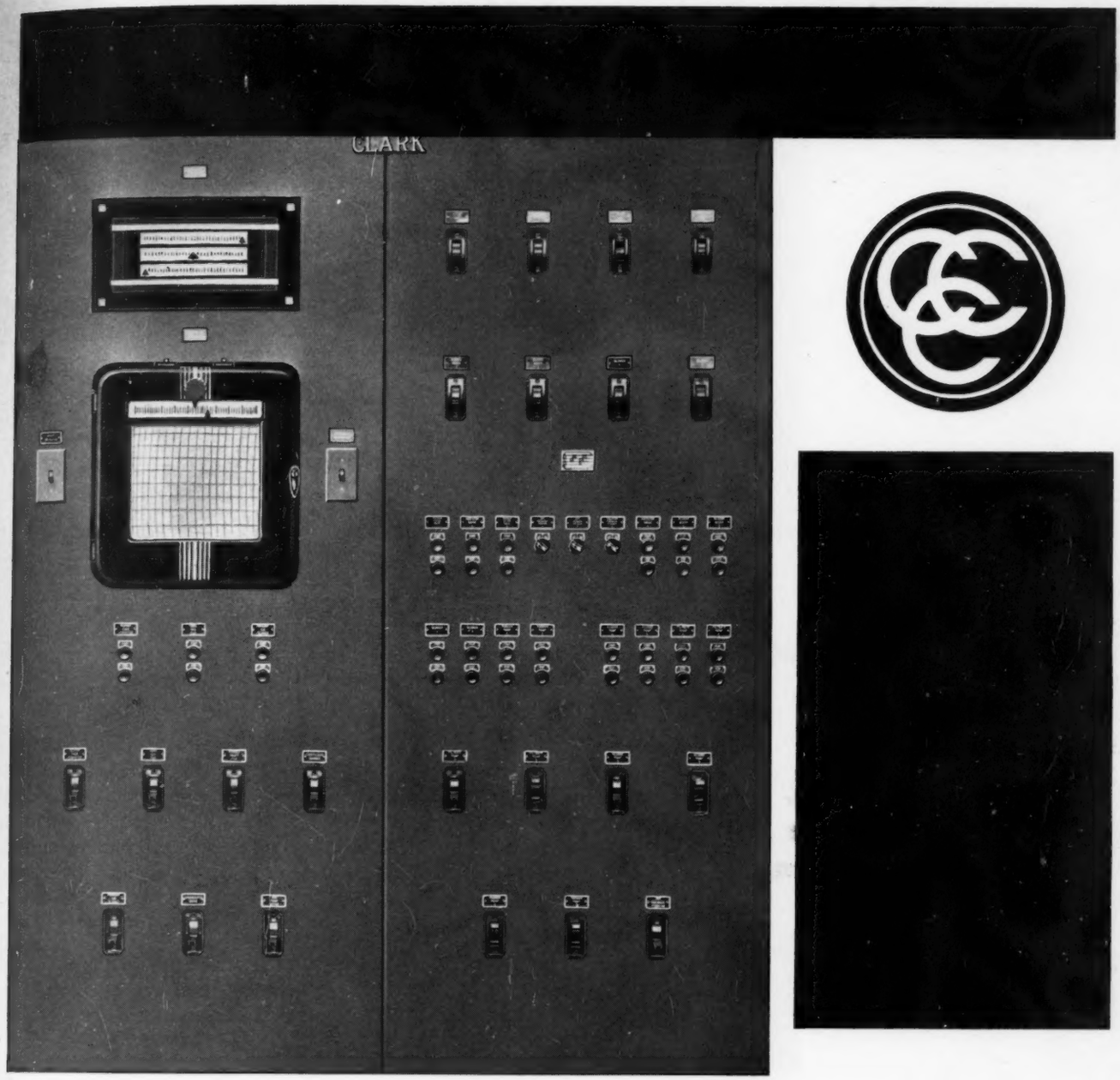
WATER WORKS & SEWERAGE

THE NEW JOINT MEETING TREATMENT WORKS
of Rutherford, East Rutherford, and Carlstadt, N. J.



(Photo by McLaughlin Air Service)

FOR water supply, gas supply, fire protection, and sanitation, cast iron pipe serves important needs in the construction of National Defense projects. We have, for ready shipment, large stocks of mechanical joint, bell-and-spigot and flanged Super-de Lavaud centrifugally cast pipe, pit-cast pipe and standard fittings in plant and storage yards throughout the country.
U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
Plants and Sales Offices Throughout the U. S. A.
U.S. cast iron PIPE
Centrifugally or Pit Cast for water works, gas, sewerage, drainage and industrial services.



● 22 Sewage Treatment Motors are controlled by this "3C" Panel . . . Each motor starter has its own Push Button for individual operation, but the Push Buttons on the panel provide for Remote Control from a central location.

The panel is also equipped with Draft Indicator and Recorder Pyrometer Instruments, thus providing visual records, as well as control, at a Central station. « « « «

"3C" Engineering is available to solve your Electrical Control problems in Sewage Treatment Plants.

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

WATER WORKS & SEWERAGE, April, 1941. Volume 88. Number 4. Published monthly at 330 South Wells Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, United States $2.00 per year; Canada $2.40 per year; Foreign $3.00 per year. Copyright, 1941. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

ALUMINUM, DEFENSE, AND YOU

ALCOA

1

WE INTERRUPT our regular messages to report what's what with aluminum.

AT THE MOMENT delivery for civilian use must make way for defense. Everybody knows the reason. Defense requires and is using more aluminum per month than peacetime America ever consumed.

NEVERTHELESS, we intend that no one shall have to forego the things aluminum can do best one minute longer than we can help.

THERE IS NO SHORTAGE of bauxite, nor of anything else, except time. And Father Time is being given the race of his life.

WE ARE MOVING, for example, 35,000 yards of earth a day at Alcoa, Tenn., to get 50 acres under a single roof by September. It will require 193 carloads of roofing felt. Some of the operations in that plant will start even before the walls are up. That's an annual rolling capacity for 120 million pounds of high strength alloy sheet coming along fast.

LAST MARCH WE STUCK the first shovel in a cow pasture near Vancouver, Wash. In September a 30 million pound plant was delivering metal. It has been doubled, already. A third 30 million pound unit starts delivering in April; a fourth in May; a fifth in June. From cow pasture to 150 million pounds annual capacity in 15 months.

A SIDELIGHT: To make that 150 million pounds of aluminum, we first have to build factories to make 120 million pounds of carbon electrodes. We have to obtain the equipment (transformers, rectifiers, and the like) to feed 162,500 kw. of electricity into the reduction furnaces. This is a generating capacity equal to that of the state of Delaware plus twice that of Mississippi.

WHAT OF TOTAL PRODUCTION? In addition to Vancouver, further installations are being made at other of our plants, so that in less than a year their total capacity will be more than double that of 1939, when 327 million pounds were produced.

IN THE VERY MIDST of this demand we have lowered the price of aluminum ingot 15%. We state, without reservation, our hope that the price can be still further reduced.

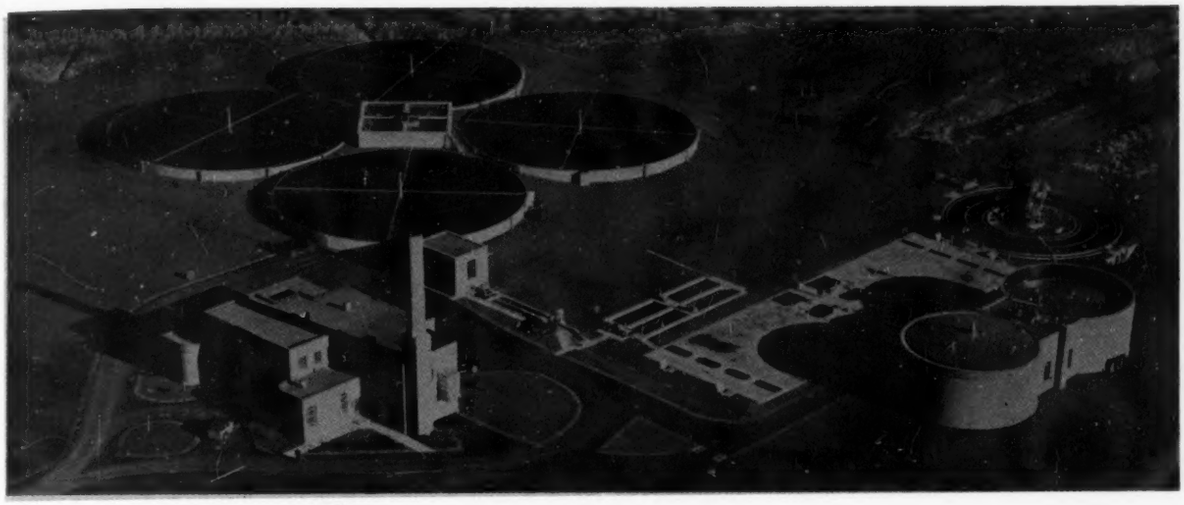
DEFENSE APPLICATIONS use aluminum for exactly the same reasons you do. Defense priorities on aluminum simply say that there are some fundamental things that aluminum does supremely well. It will do them still better as important lessons in production, fabrication, and application are learned from every additional pound being produced and used.

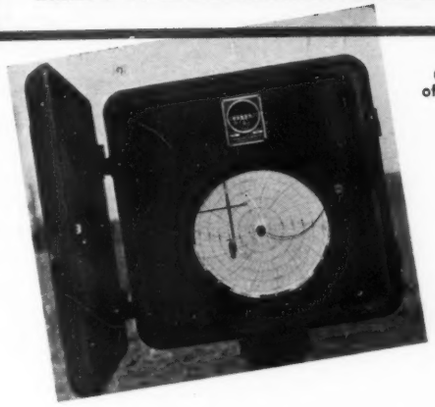
YOU, SIR, have been using aluminum for various structures, in sewage disposal plants and for plant and material-handling equipment and for painting. It is not easy nor convenient to have to substitute other materials temporarily. We want you to know that we intend to make this hardship as short-lived as possible. Your aluminum is on the way. It is a promise.

ALUMINUM COMPANY OF AMERICA

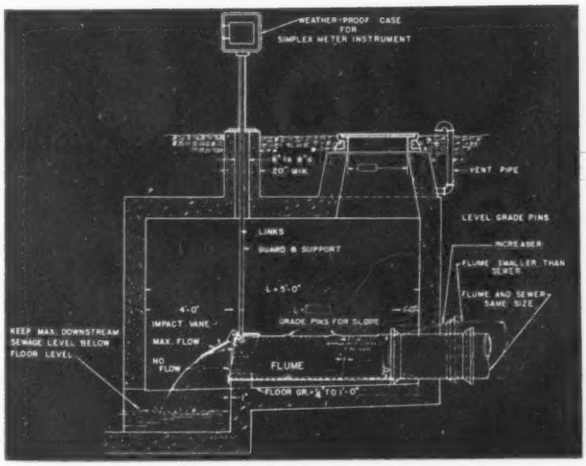
SIMPLEX Impact Flume Meters

MEASURE THE SEWAGE FLOW AT RUTHERFORD, N. J.





Close up view of Meter Header in outdoor housing.



SPECIAL consideration to the problem of measuring sewage flows at Berry's Creek resulted in the selection of Simplex Impact Flume Meters. Their installation insures high accuracies with little required maintenance.

Particularly developed for similar problems Simplex Impact Flume Meters possess these distinct advantages:

(1) A rated self scouring primary device wherein the quantity to be measured is translated into angular movement rather than into a function of depth or head.

(2) A mechanical instrument operated by means of a direct linkage connection from the primary device.

(3) An instrument which requires no float wells or floats.

(4) A highly accurate device specifically designed for measurement over wide ranges of free discharging flows.

(5) A compact metering unit low in first cost and in maintenance charges.

Write for Bulletin 210 and see how your measuring problems can be eliminated by the Impact Flume Meter.

SIMPLEX VALVE & METER CO.

6743 UPLAND STREET • PHILADELPHIA, PA.

PITTSBURGH EQUITABLE METER CO.

Announces the

based on the organization, good will and

..THE MOST COMPLETE LINE OF

IMO

ARCTIC

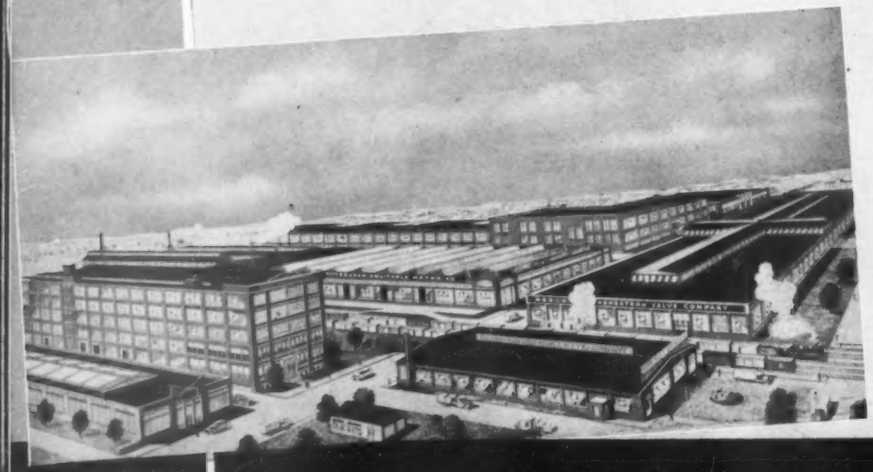
TROPIC

ARCTIC-TROPIC

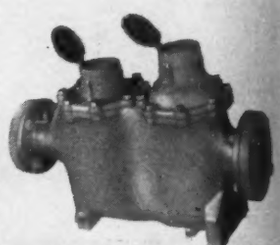
THERE has never been available a complete line of liquid meters produced by one manufacturer, which covered the entire requirements of American Industry. Believing that the interests of the trade would be more adequately served by having one company making a complete line of all types and sizes of meters, the Directors of the Pittsburgh Equitable Meter Company have purchased the assets of the National Meter Company.

The National Meter Company, the pioneer domestic water meter manufacturer, was organized in 1870, while the Pittsburgh Meter Company was founded by George Westinghouse in 1887. Each company developed and patented various types of meters for diverse uses and to accomplish precision metering under many different conditions. Each company has earned an important place for itself with municipalities, utilities and industry. Although the products have developed along different lines, they jointly represent the most complete selection of high grade meters ever offered to careful buyers.

Remarkable advances, made possible through the use of special materials developed by each company, will be available in the complete line. Hundreds of thousands of dollars have been spent in research work resulting in



EUREKA



ARCTIC-TROPIC COMPOUND

Establishment of the

NATIONAL METER DIVISION

assets of the National Meter Company

WATER METERS IN THE WORLD

improved designs, which will not only reduce costs for the buyer, but will also guarantee more accurate metering than has ever been available at any price. In addition to fluid meters, the Pittsburgh Equitable Meter Company manufactures a complete line of gas meters for handling natural and manufactured gas, sewage gas and practically all of the gases used for industrial purposes.

For the first time in history, manufacturers, municipalities and the utilities will be able to secure accurate meters for practically any liquid or gas from one company, which maintains offices and warehouses throughout the country and has sales and engineering contacts throughout the world. This company has already been called upon to play a very important part in the National Defense Program and has made large deliveries to the United States Army and Navy.

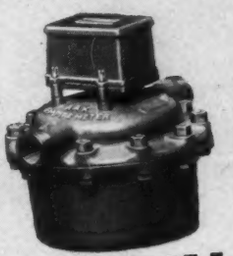
We pledge to our customers the best efforts of this organization to produce better meters and better values, based on enlarged facilities, increased production and continuous research.

W. F. Rockwell

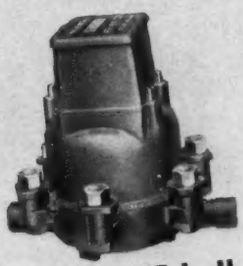
W. F. ROCKWELL, PRESIDENT
PITTSBURGH EQUITABLE METER COMPANY

EMPIRE TYPE 9

EMPIRE TYPE 8



EMPIRE TYPE 7



NASH TYPE L. H.

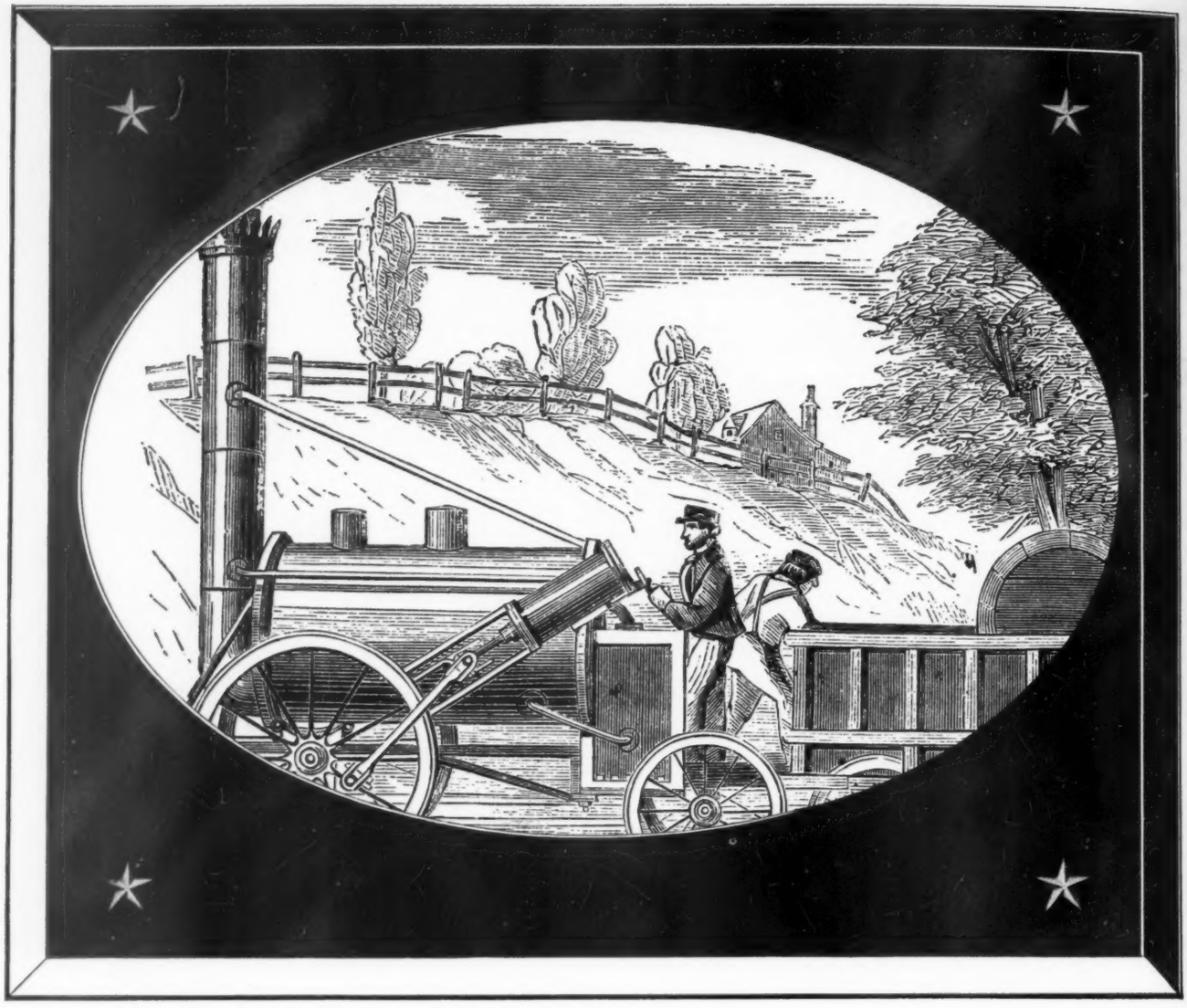
GEM AAX

EMPIRE COMPOUND

NATIONAL METER COMPANY PLANT, BROOKLYN, N. Y.

SEE US AT TH

61ST ANNUAL MEETING
AWWA
JUNE 22-26, 1941
ROYAL YORK HOTEL



They Started Something!

THE MEN WHO built the first commercially practical locomotives brought about striking changes in the history of commerce and industry—and in the daily lives of everyone. Though the energy of steam had long been known, and employed in many ways, its utilization in the locomotive ushered in a new era in transportation. Arduous journeys that once consumed days or weeks became a matter of hours. The enjoyment of travel was placed within the reach of millions, and the transportation of goods became simple and inexpensive. The development of every industry was stimulated by the greater ease in securing raw materials, and in distributing its finished products. And the railroad industry itself became a leading consumer of industry's products.

So too when the engineers of EBG first made Liquid Chlorine commercially available in America, they gave new utility to a long-known but little-used element, and their work was destined to have far-reaching effects. EBG Liquid Chlorine gave municipalities a new and effective means for controlling the spread of water-borne diseases through purification of water supplies, and is still further increasing its usefulness today in the field of sewage sterilization. The paper and textile industries were enabled to set new standards of efficiency and economy through the use of EBG Liquid Chlorine as a bleaching agent.

The first cylinder of Liquid Chlorine made by EBG in 1909.

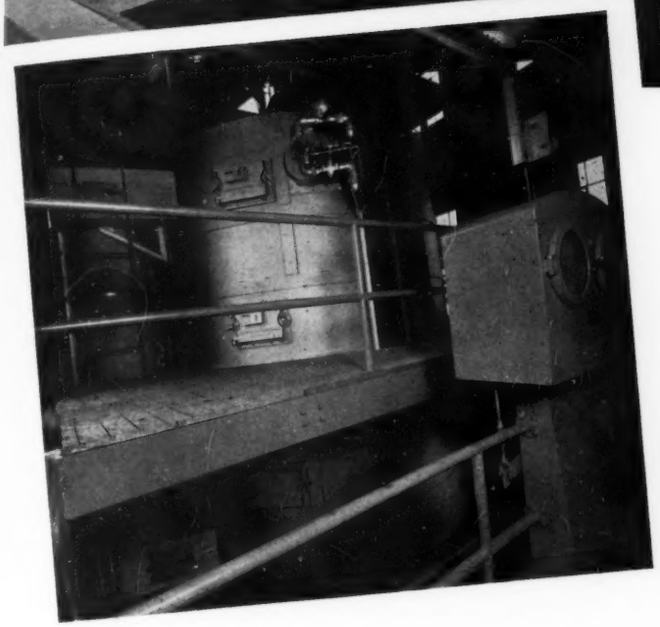
The *extra* experience of EBG engineers—pioneers in the production of Liquid Chlorine—works to your advantage. Specify EBG Liquid Chlorine when you buy.

ELECTRO BLEACHING GAS COMPANY
Main Office: 60 East 42nd Street, New York, N.Y.
Plant: Niagara Falls, N.Y.

EBG Liquid Chlorine
FIRST IN THE COUNTRY

Multi-Zone Furnace-- "Municipal" Sand Filters

Selected for RUTHERFORD, N. J. SEWAGE TREATMENT PLANT



- Upper view showing Rutherford, N. J., Municipal Sand Filter Installation. 4 M.G.D. cap.
- Lower view showing Rutherford, N. J., Multi-Zone Furnace Installation.

THE new modern Sewage Treatment Plant serving the communities of Rutherford and East Rutherford, Carlstadt, N. J., is a model of its kind. Designed to function with the greatest efficiency and dependability.

A MULTI-ZONE FURNACE and "MUNICIPAL" SAND FILTERS were chosen for their ability to maintain the high standard that the consulting engineer, Chas. Kupper, Bound Brook, N. J., so carefully specified in the plans.

The MULTI-ZONE FURNACE embodies the greatly improved principles of multiple hearth furnace operation. Completely odorless and dustless in operation. Heat in volatile gases formerly wasted in stack, used in furnace to reduce fuel consumption. No fuel required under normal operating conditions.

Designed capacity 1.50 tons per hour of 70% moisture wet cake. Used for incineration or sludge drying for fertilizer.

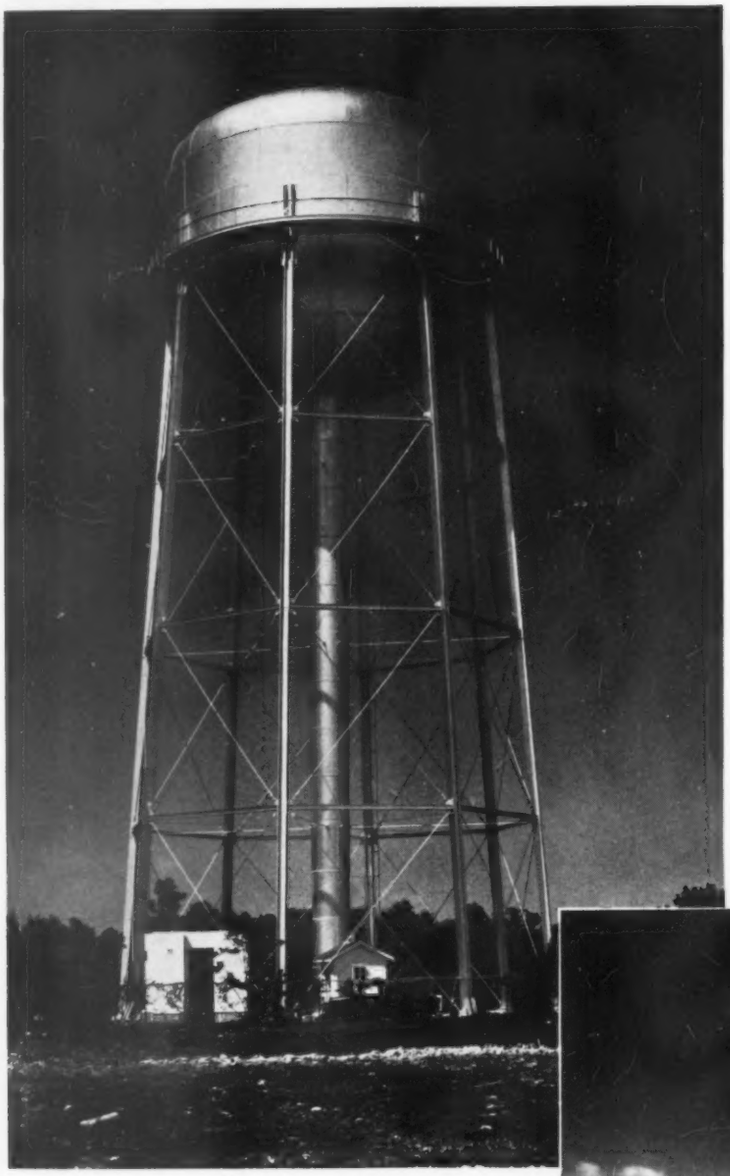
The "MUNICIPAL" Mechanically Cleaned Sand Filter is an effective and economical method of securing a high percentage of removal of suspended solids from the sewage effluent. The high efficiency of this filter permits the reduction of the settling tank volume or detention period required, since the filter can be depended upon to correct the varying removals incident to the sedimentation process, thereby producing a more uniform effluent than otherwise obtainable. Removals of 50 to 70% are usual.

Installations

Multi-Zone Furnaces	"Municipal" Sand Filters
Rutherford, N. J.	Rutherford, N. J.
Raritan, N. J.	Raritan, N. J.
Milwaukee, Wis.	Somerville, N. J.
Wisconsin Rapids, Wis.	South River, N. J.
Lansing, Mich.	Sayreville, N. J.

UNDERPINNING & FOUNDATION CO.
INCORPORATED
155 E. 44th St. New York City

HOUSTON, TEXAS



Augments water supply system with

500,000-GAL. ELEVATED TANK and 2,000,000-GAL. RESERVOIR

THE municipal water supply system in Houston, Texas, serves approximately 60,000 customers who consume an average of 27 m.g.d. The total amount of water held in storage is 4,800,000 gallons; 4,000,000-gals. in reservoirs and 800,000-gals. in elevated tanks. Two of the units in the system are shown here. The Horton ellipsoidal-bottom elevated tank at the left has a capacity of 500,000-gals., and the welded steel reservoir below a capacity of 2,000,000-gals.

Have you considered taking advantage of the many benefits that are available to your city through the use of elevated or flat-bottom storage tanks? We will be glad to discuss your requirements and furnish estimating data, without obligation. Write for complete details.

Above: The new ellipsoidal-bottom and roof tank at Houston. It has a capacity of 500,000 gals. elevated 99½ ft. above the ground. The tank is supported on an eight-post tower of structural members.

Right: Houston's new 2,000,000-gal. flat-bottom reservoir. It is 130½ ft. in diameter by 20 ft. high and is of welded construction throughout.

CHICAGO BRIDGE & IRON COMPANY

Chicago	2198 McCormick Bldg.	Birmingham	1586 North 50th Street	Philadelphia	1644-1700 Walnut St.
New York	3390-165 Broadway Bldg.	Tulsa	1646 Hunt Bldg.	Boston	1548 Consolidated Gas Bldg.
Cleveland	2262 Builder's Exchange	Houston	918 Richmond Avenue	San Francisco	1083 Rialto Bldg.
Dallas	1679 Praetorian Bldg.	Detroit	1551 Lafayette Bldg.	Los Angeles	1455 Wm. Fox Bldg.

Plants at **BIRMINGHAM, CHICAGO, and GREENVILLE, PA.** *In Canada:* **HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.**

ON GUARD!

THE unfailing purity and dependable uniformity of Diamond Liquid Chlorine safeguard your water treatment. From our centrally located plant at Painesville, Ohio, scheduled shipments are made in cylinders or cars according to your requirements.

For complete satisfaction, standardize on Diamond!

DIAMOND ALKALI COMPANY

PITTSBURGH, PA., AND EVERYWHERE

BEACHWOOD, N. J. Various sizes Class 150 Transite Pipe for complete new water system.

WOBURN, MASS. 6" Class 150 Transite Pipe.

More and More Engineers are Taking Advantage of

THIS BASIC ADVANCE IN WATER-LINE ENGINEERING

Cities, towns and villages all over the country are finding that water systems can be installed more rapidly, operated more efficiently and maintained more economically when J-M Transite Pipe is selected as the water carrier. Here are the reasons why:

Installation goes faster because Transite Pipe is light in weight, easy to handle. Long, 13-foot lengths cut down the number of joints in the line. And joints can be quickly assembled even by unskilled crews, for Simplex Couplings are actually pre-fabricated, "packaged" joints that need no heating or caulking. And joints stay tight in service . . . keep leakage to a minimum.

Tuberculation is impossible. Being non-metallic, Transite cannot tuberculate. As a result, its flow-coefficient, C=140, remains at its initial high figure indefinitely. Pumping costs stay low. Many times, this permanently high delivery capacity permits the use of smaller, less expensive pipe, for there is no need to allow for decreases caused by tuberculation.

Maintenance is negligible on Transite Pipe lines because Transite is uniformly strong and durable. It safely withstands earth loads and traffic pressure. And being inorganic, it is highly corrosion-resistant . . . immune to electrolysis.

Whether you are planning a new system or extensions to existing lines, it will pay you to investigate J-M Transite Pipe in full detail. Write for brochure TR-11A. And if you are interested in more efficient, less expensive sewage disposal, send for Transite Sewer Pipe brochure TR-21A. Johns-Manville, 22 East 40th Street, New York, N. Y.

Johns-Manville TRANSITE

For efficient, economical

ABILENE, TEXAS 18″ Class 150 Transite Pipe.

COXSACKIE, N. Y.
10″ and 12″ Class 150 Transite Pipe.

LITTLE ROCK, ARK. 12″ Class 150 Transite Pipe.

BROWNWOOD, TEXAS
18″ Class 150 Transite Pipe.

VANCOUVER, WASHINGTON
Various sizes Class 150 Transite Pipe.

PIPE *AN ASBESTOS PRODUCT*

water and sewer lines

Something Entirely New!

IN WATER TREATING EQUIPMENT

THE GRAVER *REACTIVATOR*

HERE is a water treating development that tops any equipment on the market. It is a condensed unit that softens and clarifies your water supply—reduces the reaction and settling time, of from 4 to 8 hours, to not more than 60 minutes—and actually improves the quality of water delivered over that obtainable from a conventional type settling tank.

UPWARD SLUDGE FILTRATION—that's the principle that "delivers the goods," and it's an exclusive Graver feature (patented).

Actual tests on water of 20 grain hardness per gallon and 200 p.p.m. of turbidity resulted in reduction of hardness to approximately 3 grains per gallon and turbidity to 20 p.p.m.

Here is equipment that certainly warrants immediate investigation. Can you afford not to know all about it? No obligation!

Clip this Coupon and Mail Today

GRAVER TANK & MFG. CO., INC.
5007 Tod Ave. East Chicago, Ind.

Please send more information on the Graver Reactivator.
Also send complete data sheets on the following:

- ☐ Aeration
- ☐ Baffle Plate Aerator
- ☐ Coke Tray Aerator
- ☐ Oil Removal Filters
- ☐ Diffuser Type Aerator
- ☐ Taste and Odor Removal Filters
- ☐ Raschig Ring Aerator

Name .....
Company ..... *Title* .....
City ..... *State* .....

* Patented and Patents Pending

GRAVER TANK & MFG. CO., INC.

NEW YORK
CATASAUQUA, PA

5007 Tod Ave.
EAST CHICAGO, IND.
CABLE ADDRESS—GRATANK

CHICAGO
TULSA

THESE ARE THE REQUIREMENTS...
CAN YOU MEET THEM?

TO INCINERATE A COMBINATION OF GREEN GARBAGE AND SEWAGE FILTER CAKE..

TO INCINERATE GREEN GARBAGE ALONE....

TO INCINERATE SEWAGE FILTER CAKE ALONE..

TO GUARANTEE PERFORMANCE...

YES! ...Said Incineration Headquarters!

INCINERATION HEADQUARTERS

... the country's most authoritative organization on all matters relating to the incineration of municipal wastes ... maintains an integrated program of laboratory study, field research and plant design, assuring only equipment that is tried and proven.

Now, let the Rock Island Argus tell the story—

"On recommendation of the committee sent to Maryland and New Jersey last week to inspect incinerators, the council awarded the Nichols Engineering and Research Corporation of New York City the contract for furnishing and installing incinerator equipment at a cost of $68,750.

The committee reported that incinerator equipment costing about $50,000 less, on which bids were received last week, was unsatisfactory. Members explained the equipment would burn garbage alone and garbage and sewer sludge combined, but would not burn sewer sludge alone, as will be necessary in Rock Island, without the use of considerable additional fuel.

Committee members, in explaining their recommendation for the purchase of the more expensive incinerator equipment, said the cheaper equipment failed to burn the sludge and garbage thoroughly and that working conditions in plants where such equipment was in operation were far from proper."

Quoted from The Rock Island Argus, 1-23-40

NICHOLS ENGINEERING & RESEARCH CORPORATION

60 WALL TOWER BLDG., NEW YORK, N. Y. NERCO UNIVERSITY TOWER BLDG., MONTREAL, P. Q.

"Skyscraper" WATERWORKS

TOWN OF LAKE, WISCONSIN

Make your plans to attend 61st annual meeting of A. W. W. A.— Toronto, Ont., June 22-26, 1941.

Used HTH to sterilize million gallon system

● One of the most unusual municipal buildings in the country is located in Town of Lake, Wisconsin. What appears to be a "skyscraper" building is actually a concrete enclosed steel water tank . . . at the base of which is located the water department, softening plant, pump room, and other offices pertaining to municipal management.

Designed by William D. Darby, consulting engineer, this modern waterworks is supplied by well water which is stored in the enclosed tank. The distribution system consists of 43 miles of mains of various sizes, and holds about 250,000 gallons when in static condition.

HTH comes in 5-lb. cans with replaceable caps, packed 9 cans to the case; also in 100-lb. drums.

The entire waterworks, including a 40,000 gallon settling tank, was sterilized with Sanitation HTH before actual operations were begun. Using 50 p. p. m. of available chlorine 1,050 lbs. of HTH were required for this thorough sterilizing operation. Reports Engineer Darby, "We obtained very satisfactory results."

Sanitation HTH is a dry, free flowing carrier containing more than 70% available chlorine. Many waterworks engineers keep it on hand for sterilizing new or repaired mains and for any and all emergencies requiring a mobile high test chlorine carrier. Send for 80-page booklet: "Hypo-Chlorination of Water."

THE Mathieson Alkali Works (INC)
60 E. 42ND ST., NEW YORK, N. Y.

LIQUID CHLORINE . . . HTH . . . SODA ASH . . . CAUSTIC SODA . . . BLEACHING POWDER . . . AMMONIA, ANHYDROUS and AQUA . . . BICARBONATE OF SODA . . . PH-PLUS (FUSED ALKALI) . . . DRY ICE . . . CARBONIC GAS . . . SYNTHETIC SALT CAKE . . . SODIUM CHLORITE PRODUCTS

TORONTO *Welcomes* AWWA

JUNE 22nd-26th

61st Annual Convention American Water Works Association Royal York Hotel

● A.W.W.A. President Norman J. Howard, who is Director of Water Purification, Toronto, together with all other officers and Directors of the A.W.W.A. extend to all members and guests a most cordial invitation to attend the 61st Annual Convention to be held in Toronto, Royal York Hotel, June 22-26th, 1941.

A committee of eleven under the Chairmanship of William J. Orchard has arranged an outstanding technical and entertainment program—one that you cannot afford to miss.

Advance Hotel Reservations point to an excellent attendance. If you have not made such arrangements, we urge that you do so without further delay. Many "Conventioneers" will recall the successful Convention held in Toronto twelve years ago, when the attendance reached an all time high. If further details or additional information are desired, write to Joseph M. Wafer, 230 Park Ave., New York, N. Y.

(Space for this advertisement has been donated by
WATER WORKS AND SEWERAGE
in cooperation with attendance committee)

What'll we do?

Our water supply is polluted . . . and it connects with the city mains!

HUNDREDS of thousands of citizens were in danger. The distribution system of a great city was interconnected at one point with a private water supply . . . and the latter had become dangerously polluted!

A steel piling driven into the ground had shattered a pressure sewage main. Sewage flowed into a private water system which was cross connected to the municipal water supply. There was no sure way to determine whether any of the polluted water had reached the city mains . . . but there *was* a quick, dependable method right at hand to sanitize the supply. The municipal plant was amply prepared with Perchloron!

Perchloron, solution barrels, and a pump were immediately loaded on a water works truck and set up at a fire hydrant near the potential source of pollution. Perchloron solution was pumped into the city main, providing emergency chlorination that protected the population against danger.

That is an instance of the way Perchloron fits in. Plants in every section of the country have found how well it pays to be prepared with Perchloron. They use it, not only for emergency chlorination, but for sanitizing new mains, for clear wells and filters, and for swimming pool sanitation.

Perchloron, a dry, free-flowing granular material, contains more than 70% available chlorine. It is stable, concentrated, uniform. Ready-to-use solutions are quickly prepared by dissolving it in tap water. Packed 9 handy-sized cans to the case, each can with Kork-N-Seal cover. Also in 75-lb. drums. Write for free booklet. Pennsylvania Salt Mfg. Co., Widener Building, Philadelphia, Pa.
New York • Chicago • St. Louis
Pittsburgh • Tacoma • Wyandotte.

Perchloron

PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals

THIS IS THE *Sphere*

THAT HOLDS THE GAS
THAT MAKES THE STEAM
THAT HEATS THE PLANT

at WAUSAU
WISCONSIN

EFFICIENT, economical storage of digester gas in Wausau's modern sewage disposal plant is provided by an all-welded P·DM pressure sphere.

The sewage passes through sedimentation tanks, where the sludge is separated from the liquid; the sludge then is pumped to the digester units, where gas is produced for storage in the sphere—to be used as required for fuel which steam-heats the plant buildings and digesters.

Indicative of P·DM's ability to handle your own current problems, the details on this and many another noteworthy Pittsburgh-Des Moines contribution to the sewage works field will interest you. Write—without obligation.

PITTSBURGH · DES MOINES STEEL COMPANY

BETTER BUILT · AT LOW COST

PITTSBURGH • DES MOINES STEEL CO.

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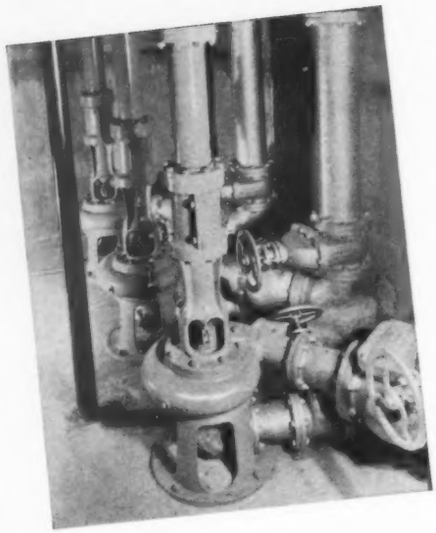

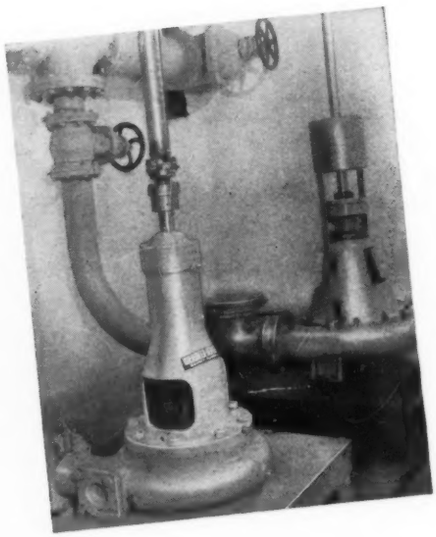

THE MARK OF HIGHER EFFICIENCY

● Large cities and small—in every part of the country—report greater savings with Gardner-Denver sewage and waste-disposal centrifugal pumps. That's because the higher efficiency of these pumps keeps more dollars in the water works budget.

The higher efficiency of Gardner-Denver sewerage centrifugals that enables them to effect such savings is assured by accurate impeller and casing design—properly proportioned water passages—rugged construction, with a minimum number of wearing parts.

To keep more dollars in your budget, install high efficiency Gardner-Denver centrifugals in your sewerage system. Write for descriptive bulletin. Gardner-Denver Company, Quincy, Ill.

GARDNER-DENVER

Since 1859

$30,000 WORTH OF PIPE LINE

CARRYING CAPACITY FOR $10,000!!!

TODAY ! ➡

New York to Florida in six hours!

THE STORY BEHIND THE HEADLINE . . .

It is now possible to clean a water main and line it with cement right in position.

You can clean up an old line and more than restore its original carrying capacity—as good as new—*for approximately 1/3 the cost of a new main.*

By cement lining a pipe in position you have

- one continuous pipe line
- no more joints
- no more leaks
- no more incrustation
- no more red water
- no more clogged pipe
- increased the carrying capacity beyond that of a new line
- Reduced pumping costs in many instances as much as 50%.

ACTIVATED ALUM CORPORATION

Curtis Bay — Baltimore, Maryland

"You get the good things first from Activated Alum Corporation."

⬅ JUST YESTERDAY

I Don't Believe It! You Can't Do It!

THE PROCESS has been under research and development to the point where it is now accepted by

—leading engineers
—leading authorities in the field of water works practice.

RECENT WORK at Charleston, South Carolina—West Palm Beach, Florida — Falmouth, Massachusetts — Shamokin, Pennsylvania, has convinced investigators this is the coming trend in restoration of a distribution system—without laying new mains.

THIS DEVELOPMENT is a process of the United Kingdom—recent U. S. patents recently granted (owner of U. S. patents—Tate Pipe Linings, Inc., Andover, Mass.). There are Tate companies operating in London, England

Kulti, India
Sydney, Australia
Auckland, New Zealand
Salt River, Cape South Africa

THINK. For a $10,000 appropriation, you can get $30,000 worth of pipe line carrying capacity by this Tate process of cleaning and lining cast iron water mains in position.

Activated Alum Corp.
Curtis Bay
Baltimore, Maryland

Please send me your booklet telling the whole story of the Tate process, inside and out—with illustrations and descriptions of all procedures. No obligation to me.

Name .....

Affiliated with .....

Address .....

City ..... State .....

Just paste this coupon on a penny post card and mail it

"You mean I gotta DIG *before I can* 'Tell All'?

I thought you said it was **EASY**"

No, Sir; we said it was *simple!*

In our promotion of the TELL ALL principles we may have used the term "simple" carelessly. The fundamentals *are* simple, but there is no substitute for digging up facts; nor for hard thinking. And thinking is not easy.

Yes, Sir; we *do* mean that you have to get out in the field and dig in order to use the TELL ALL principles that many advertisers have found profitable. You've got to know all before you can tell all. But if you'll tell more, you'll sell more. Isn't that worth the effort? And isn't that *your* job?

In the first* of this series of answers to questions about "TELL ALL", we told why A.B.P. is promoting this return to the fundamentals of sound copy, what part of it was the publisher's responsibility, and why we should have done it long ago. Page 2 of the "TELL ALL" book, above, discusses the part of the job that is the advertiser's responsibility; and his opportunity.

*Reprint on request.

2

And We Nominate You for a Job, Too

MR. ADVERTISER

. . . A Job That Will Pay You Handsomely

THAT JOB is the digging out of your real sales story developed from the viewpoint of your potential customer or dealer. He is the man who reads the business papers in which you advertise. He is the man to be sold and the only way to sell him is to give him facts in your advertising from which he can determine the worth of your goods, *to him*—or why it's worth his while to give your product a "break" at the point of sale.

It's an important job! Without it you cannot fully use the tremendous potential sales power of hard-selling advertising in business papers. It is absolutely essential that you analyze your products, your sales opportunity, your competition, the requirements and interests of your prospects, and give that sales story to your copy man. *Only then* can your advertising be interesting, informative, helpful and convincing. Only then can your advertising *"tell all"* that the business paper *reader wants to know!* Only then will the selling power of your business paper advertising be fully apparent to you.

Look at it this way: When there's a big order at stake, any and every business head considers it just horse sense to study carefully the sales approach he will take. How much more important it is to plan with utmost care the approach to thousands of customers and prospects through your business paper advertising.

The business paper reader *wants* to know. He wants to know ALL. That is the *only reason* he reads business papers.

Because business papers are read for information, not for fun, these Tell All principles work:

"Give each ad a specific objective; tell all that the reader must know before he can be expected to act; and *prove* it!"

"Don't generalize; get down to cases; talk in terms of the special interests of your various prospects in special markets."

"Give the reader some idea of prices, or costs!"

"Be specific. Sales are made, companies are built, product by product. So—*advertise* product by product. They don't buy your 'line'. They buy your 'products'."

"Make your advertising USEFUL!"

"If you are trying to get a dealer to display and push your products over the counter, don't stop at telling him about your consumer advertising. Tell him all the reasons why your product is a buck twenty higher than most, if it is. Tell him how to display it. Show him how to make money out of it. Give the reader the same sort of help that he gets from the editorial pages of his dealer paper. That's the only reason he reads it!"

"If it's inquiries you want, you can get them all right . . . if you offer something that's really useful to the reader and tell him why it's useful!"

"Don't be afraid of long copy. Make it informative!"

"Don't get fed up with your own sales story. No matter how often you get tired of seeing the same old arguments presented in print, remember this—if you know your product and your market, and tell your sales story from the prospect's viewpoint, it's the only story you've got. Change the pace, use new approaches, produce fresh evidence that your story is true; but never stop telling it, never stop telling all of it."

"If it's direct action you're after, suggest it in your copy and tell the reader why he'll get something out of acting!"

WATER WORKS & SEWERAG

330 South Wells St., Chicago

155 E. 44th S New York

GLENCOE, ILLINOIS USES GENERAL CHEMICAL Aluminum Sulfate and Anhydrous Bisulfite of Soda

The attractive Glencoe water purification plant on the shore of Lake Michigan supplies pure, wholesome, palatable water every day of the year.

Lake Michigan is virtually an inexhaustible source of reasonably pure water . . . but frequent storms stir up sediment and make the water unsightly. Conversely, calm weather and bright sunlight stimulate the growth of various micro-organisms, some of which clog filter surfaces, while others impart disagreeable tastes and odors to the water. *For more than ten years, Glencoe has successfully overcome these problems with the aid of General Chemical Company water treatment chemicals.*

General Chemical Aluminum Sulfate coagulates and settles out turbidity and suspended micro-organisms. Subsequent super-chlorination in the mixing basin removes residual tastes and odors, keeps the filter sands sweet and clean.

General Chemical Anhydrous Bisulfite of Soda (A.B.S.) removes excess chlorine in the filtered water. At Glencoe this is applied as a solution—in the proportion of 1.6 parts of A.B.S. to 1.0 part of residual chlorine. (General Chemical A.B.S. is a dry powdered material which can be dry or solution fed, as desired.)

We will welcome your inquiries on any of the following General Chemical products for use in water treatment and will gladly offer assistance on their use:

ALUMINUM SULFATE • ANHYDROUS BISULFITE OF SODA • AQUA AMMONIA • SODIUM SILICATE SOLUTION • MONOSODIUM PHOSPHATE • DISODIUM PHOSPHATE TRISODIUM PHOSPHATE • TETRASODIUM PYROPHOSPHATE • SODIUM SULFATE

Plan now to attend the 61st Annual Meeting of the American Water Works Association, Royal York Hotel, Toronto, Ontario, June 22-26, 1941.

GENERAL CHEMICAL COMPANY
40 RECTOR STREET, NEW YORK, N. Y.

Sales Offices: Atlanta • Baltimore • Boston • Buffalo • Charlotte (N. C.) • Chicago Cleveland • Denver • Detroit • Houston • Kansas City • Milwaukee • Minneapolis Newark (N. J.) • New York • Philadelphia • Pittsburgh • Providence (R. I.) St. Louis • Utica (N. Y.)
Pacific Coast Sales Offices: San Francisco • Los Angeles
Pacific Northwest Sales Offices: Wenatchee (Wash.) • Yakima (Wash.)
In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

SANITATION IS VITAL TO TOTAL DEFENSE!

With hundreds of thousands of men being put "thru the mill" at Uncle Sam's Air Bases, Army Camps, and Cantonments, the vitally important problem of Sanitation has to be met quickly by the Military, their contractors, and the overloaded municipalities whose water and sewage disposal plants serve the Army and Navy.

%Proportioneers, Inc.% are doing their part for the Defense Program. In Army and Navy Bases, Camps, and Cantonments from coast to coast, %Proportioneers% Chemical Feeders are being installed every day for water purification, sewage sterilization, emergency chlorination, and sterilization of newly laid mains.

We are under contract to the U. S. Navy to supply mobile water purification plants such as previously built for several Armies—friendly European and U. S. A.

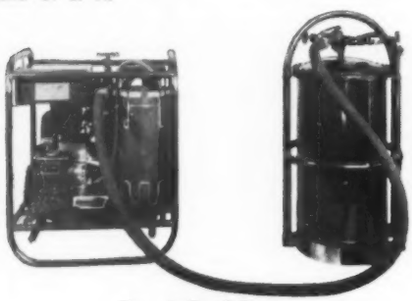

Fig. 1—Pur-O-Pumper

These "packaged water plants"—Pur-O-Pumpers, Fig. 1—can be carried to the job on a light truck, installed either for temporary or semi-permanent use near a stream. Lower the suction hose into the stream, start the gasoline engine, and the water plant starts operating! The water is treated with coagulant chemicals, soda ash and alum, and chlorine for sterilization as it is pumped into the filter. Pure, clean, SAFE, water is immediately available. Full details about these "man-saving" PUR-O-PUMPERS upon request.

We may be claiming too much to liken the Midget Chlor-O-Feeder, Fig. 2, to Geo. Washington, but "first in peace, first in war" seems to hold true just the same! For years Chlor-O-Feeders have been making all kinds of water supplies safe for human consumption. Now, actively at work on the Defense Job, Chlor-O-Feeders are covering themselves with more glory as the small, handy, thoroughly dependable chemical feeder suitable for whatever job comes up. If you are laying new mains, Chlor-O-Feeders will sterilize them for you; if you must use an untreated water source, Chlor-O-Feeder will sterilize it; if denied the benefits of a sewage treatemnt plant, let the Midget safeguard the effluent! Engineering adive and typical installation diagrams covering dozens of uses are available—just write us your needs, we'll do the rest, PROMPTLY.

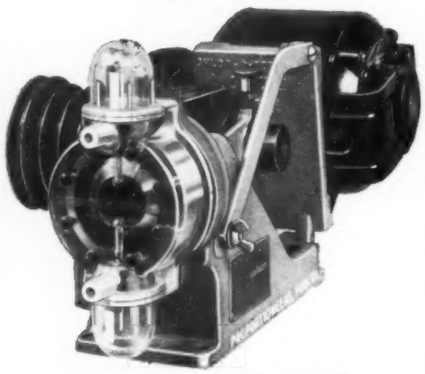

Fig. 2—Heavy Duty Chlor-O-Feeder

With the Military, who really want the best—and want it quickly—it's %Proportioneers, Inc.% from coast to coast.

%Proportioneers% Chemical Feeders are giving their best for the Defense Program. Some recent installations include:

Quonset Point Naval Air Station, R. I.
Cold Weather Air Base, Alaska
Fort Wetherell, Jamestown, R. I.
Fort Getty, Jamestown, R. I.
Camp Edwards, Falmouth, Mass.
Camp Joseph T. Robinson, Little Rock, Arkansas
Camp Bullis, Texas

%Proportioneers% Chemical Feeders are also serving combat forces on route.

Visit our—
"House of Magic"
A.W.W.A.—Toronto

%PROPORTIONEERS, INC.%

"Chemical Feeder Headquarters"

9N Codding St. **Providence, R. I.**

WATER WORKS & SEWERAGE

PUBLICATION OFFICE
330 South Wells Street, Chicago, Ill.
E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor

COMING!

"The Maintenance of Large Meters in the Field"

Is a worth while discussion on an important topic in which dribbles are measurable in sizeable gallonage and losses in dollars per day rather than pennies per week. This article reveals field maintenance experiences and suggests improved methods for accuracy checking of large meters in place. Some fallacies discovered in the generally accepted methods are revealed and advantages are cited for methods developed under the author's direction, which are described in this article by—
D. R. TAYLOR, Plant Superintendent, Roanoke, Va.

"Operating Fundamentals of the Activated Sludge Process"

Those who have read earlier contributions of the author will need no encouragement to watch for his forthcoming article on the above topic. A former designer and an experienced operator since, as well as a keen observer, the article to appear will prove a valuable guide to activated sludge plant operators—and, too, to designers. It is, however, written for operators by an operator to aid in attaining dependable and economical plant performance. The author—
T. R. HASELTINE, Sup't of Sewage Treatment, Butler and Grove City, Penna.

"Some Pertinent Considerations in Water Corrosion and Corrective Measures."

Constitute the basis for interesting disclosures by a chemist and engineer who has made a careful study of the chemical make-up of a number of waters, and of varied quality, in relation to practical observations on the condition of mains and service pipes carrying these waters. The author presents a new thought for consideration in evaluating or predicting corrosivity of waters. He suggests a procedure for readjusting the hardness alkalinity balance upset by the refining process of coagulation and filtration, which seems to be an underlying cause for the general observation that filtered waters are pronouncedly more corrosive and tuberculating than unfiltered waters. This thought provoking discussion comes from—
THOMAS R. RIDDICK, Consulting Engineer and Chemist, New York, New York

"Experimental Digestion Studies"

Constitutes a reporting and discussion of findings in a study of digester performance and sludge quality as the result of applications of moderate quantities of powdered activated carbon to sludge entering the digesters of the Lancaster, Pa., Treatment Works. The author, formerly Chemist at Lancaster, is—
GORDON J. WEIST, Supervising Chemist, Sewage Treatment Works, Chester, Pa.

"Water Hammer Corrections"

Is an article which discusses methods and equipment available on the market for most successfully correcting the disturbing and destructive pipe line surge or water-hammer. Included is a highly useful section devoted to shock absorbing devices found effective as water hammer suppressors for small pipe lines and consumers piping systems. The author—
RICHARD BENNETT, Hydraulic Engineer, City Engineer's Office, Phoenix, Ariz.

"Waste Disposal Problems of the Petroleum Industry"

Relates the nature and complexity of the problem of purifying and disposing of the heterogeneous wastes from petroleum production and its refining—a problem of increasing magnitude and interest nationally. Planned to run in this issue, but again unavoidably delayed, this article will appear in May. It will constitute the second of a series of articles which will deal with methods of treatment and disposal developed during eight years of endeavor by an important unit of the industry itself. The authors—
W. B. HART, Director of Wastes Disposal,
R. F. WESTON, Sanitary Engineer,
The Atlantic Refining Co., Philadelphia.

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Retirement

The SYMBOL of SUSTAINED ACCURACY

EXPERIENCED OPERATORS agree that whether 1 or 40 years old, Trident Meters emerge from the repair shop literally better than when new, capable of passing the strictest repaired meter tests, and ready for many more years of hard service. In other words, they never need to be retired!

● Trident Interchangeability is what does it . . . for every new and improved Trident Meter part is made to fit perfectly into every standard Trident Meter, no matter how old! When you buy Tridents, you get a fountain of youth in meter performance . . . a service to keep your meters young.

TRIDENT
INTERCHANGEABILITY
means
ECONOMY IN INVENTORY
EFFICIENCY IN MAINTENANCE
RELIABILITY IN PERFORMANCE
ASSURANCE
AGAINST RETIREMENT
UTMOST IN REVENUE

61st ANNUAL MEETING AWWA JUNE 22-26 1941 ROYAL YORK HOTEL TORONTO CANADA

NEPTUNE METER COMPANY · 50 West 50th Street, NEW YORK CITY
Branch Offices in CHICAGO, SAN FRANCISCO, PORTLAND, ORE., DENVER, DALLAS, KANSAS CITY, LOUISVILLE, ATLANTA, BOSTON.
Neptune Meters, Ltd., 345 Sorauren Avenue, Toronto, Canada.

WATER WORKS & SEWERAGE

VOL. 88, NO. 4 *A Gillette Publication* APRIL, 1941

A COMBINATION CHEMICAL-BIOLOGICAL SEWAGE TREATMENT PLANT

Serves the Joint Meeting of Rutherford, East Rutherford and Carlstadt, N. J.

By ALBERT B. KOZMA, C.E.
Plant Superintendent
RUTHERFORD, NEW JERSEY

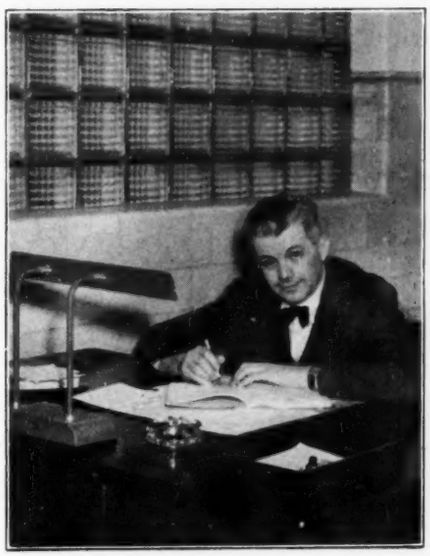
THE Hackensack River and its tributaries are the last major intrastate waters in metropolitan New Jersey which are still polluted by untreated domestic sewage and industrial wastes. The first step in the direction of cleaning up this stream was taken by the Boroughs of Rutherford, East Rutherford and Carlstadt when these communities joined hands to clean up the waters of Berry's Creek, an important tributary of the Hackensack River.

History of the Development

The formation of Sewer Districts for the purpose of disposing of their wastes is not new in New Jersey, as the examples of the Joint Meetings representing the Elizabeth, Passaic, and Rahway Valley Districts show. However, the formation of this newest Joint Meeting was exceptional in one respect, namely, the fact that it was established more expeditiously than any of the others. This fact resulted in substantial savings, both in construction and operating costs, benefiting all the participants and establishing a worthy example to other combinations of similar nature.

All three boroughs which participated in this enterprise were served a final order from the State Department of Health at about the same time. In the early part of 1937, each was notified to cease pollution, and each proceeded independently to comply with these orders.

The Borough of Carlstadt engaged Mr. Charles J. Kupper, consulting engineer of New Market, N. J., to prepare preliminary plans for a plant of 0.8 M.G.D. capacity, the proposed treatment to consist of chemical precipitation, followed by intermittent slow-sand filters and chlorination. About 10 per cent of the total flow represented industrial wastes.



The Author

Similarly the Boroughs of Rutherford and East Rutherford proceeded with the preparation of plans and they engaged Mr. Ronald B. Brown, consulting engineer of Rutherford, N. J., who had been serving them as Borough Engineer for quite some time, to do the engineering work. The Borough of Rutherford required a plant of 1.3 M.G.D. capacity, its sewage being predominantly domestic but septic. East Rutherford needed a plant of 1.1 M.G.D. capacity, 0.35 M.G.D. representing industrial wastes. The proposed method of treatment was similar to that of Carlstadt, i.e., chemical precipitation followed by intermittent sand filtration and chlorination.

When the district office of the Public Works Administration received these plans, together with applications for government grants, Mr. C. J. Velz, then District P. W. A. Engineer, arranged a meeting of the representatives of the three communities and their engineers to point out and recommend the advantages of having one single plant in place of three individual plants. The soundness of this consolidation of interests from an engineering and economic point of view proved acceptable; and from this point it was through the untiring efforts of the representatives of the three municipalities, dealing with the governmental and financial phases, that the scheme was carried out. Rutherford, being the largest community of the three, took the leading part in the negotiations under the leadership of Mr. Frederick V. Hugo, then Mayor of Rutherford. Those who served as leaders for their towns were Mr. John W. Petrie, Mayor of East Rutherford; Mr. William G. Miller, Commissioner from East Rutherford; Mr. William H. Nussbaum, Mayor of Carlstadt, and Mr. Joseph Spevack, Commissioner from Carlstadt.

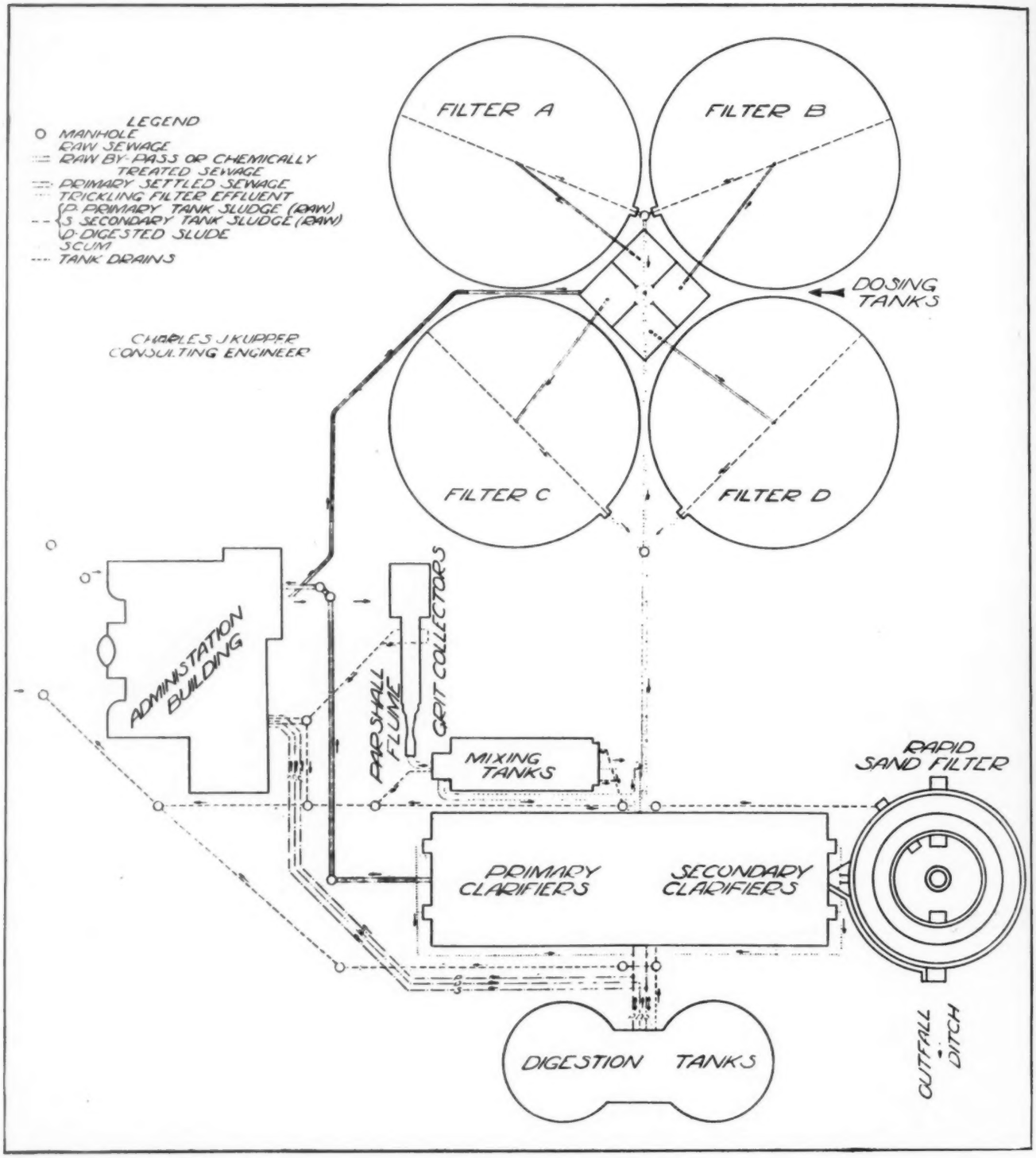
The Joint Meeting was organized within a few months and Mr. Charles J. Kupper of New Market, N. J., was appointed consulting engineer to prepare all plans and specifications. Mr. Ronald B. Brown, Borough Engineer of Rutherford, was commissioned to

carry out supervision of all field work, and Mr. William G. Ihnen, Borough Engineer of Carlstadt, was requested to furnish all field information in reference to Carlstadt.

Organization of the Joint Meeting

The Joint Meeting was organized in October, 1938. Its charter was drawn up in conformance with the statutes of the State of New Jersey, under chapter 36, laws of 1899, and revised as set forth in the Revision of Statutes, section 40:63-68 to 139. This statute authorizes "two or more municipalities in this state, without regard to their form of incorporation, to jointly provide for and cause to be constructed and to thereafter maintain an outlet or trunk sewer, or sewers, or drains, or disposal works."

In forming the Joint Meeting it was provided that to defray construction costs each municipality should be assessed in proportion to the volumes of sewage flow contracted for. The costs of operation and maintenance are apportioned between the three municipalities on the basis of contributed flows, as metered, from each community. Rutherford assumed 1.3 M.G.D. of the total capacity, East Rutherford 1.3 M.G.D. and Carlstadt 0.9 M.G.D., making a total of 3.5 M.G.D. Subsequently



Flow Diagram of the 4 M.G.D. Plant

Combining Chemical, Mechanical and Biological Treatment, in a Highly Flexible Manner.

Rutherford increased its participation to an equity of 1.8 M.G.D., thus raising the total capacity of the plant to 4.0 M.G.D., for which it was designed and built.

Cost of Project

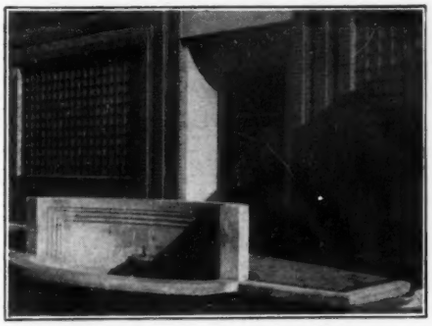
The total cost of the project, based on the contract awards, was $903,890. This figure does not include the engineering and legal fees, rights-of-ways and other minor miscellaneous costs. It is divided up among the various items as follows:

Trunk Line	$217,000
General Contract	644,000
Plumbing	2,170
Heating and Ventilating	8,600
Electrical	14,850
Landscaping	11,650
Office Furniture	1,500
Laboratory Equipment	2,400
Tools and Portable Pumps	1,720

Basis of Design

Preliminary investigations showed that the domestic sewage was unusually heavy in suspended solids and B.O.D. In addition thereto, the sewers received a great variety of industrial wastes such as dye, textile, paper, laundry, plating works, ink and other chemical by-products to be considered. For this reason it was decided that chemical precipitation should be provided to aid or supplement biological treatment.

The plant was designed for a future population of 35,000. A general survey was made to determine the industrial load and it was found that its then existing volume was about



Administration Building Entrance.

0.5 M.G.D., corresponding to a population of 20,000. Assuming a future expansion of 50 per cent, the total future population for design purposes (both actual and equivalent) was assumed to be 65,000. On this basis, the cost of the plant proper runs to a little over $10 per capita.

The final design of the plant was developed after a long, painstaking search into the best methods adaptable for local conditions. The first scheme called for chemical treatment followed by intermittent sand filtration and chlorination, but it was soon found that the costs were prohibitive. Subsequently trickling filters were substituted for slow-sand filters as the backbone of the treatment system, these to be supplemented by chemical treatment. A further problem arose in connection with the disposal of the sludge. Various solutions were proposed such as sludge digestion and drying beds, sludge digestion and vacuum filtration, and sludge digestion with vacuum filtration and incineration. Finally the last scheme was adopted in view of the fact that it was questionable whether the sludge would always fully digest, due to the presence of various industrial wastes. The availability of a sludge incinerator will make it possible to bypass the sludge digesting tanks, when and if conditions warrant, and dispose of the raw sludge by dewatering on the vacuum filters and incineration.

The keynote of the design was flexibility to the highest permissible degree. With this objective in mind, various elements of the biological and chemical treatment were interconnected, and drains, pipe galleries, etc., were provided to bring the various units together in what circumstances may dictate to be the most desirable and effective operating combinations.

Operating Costs

The plant is predominantly a mechanized plant, i.e., labor saving machinery has been provided wherever practicable in order to eliminate manual handling and thus keep down operating costs. The operating force consists of a superintendent, a chemist, four shift operators, and a helper employed when needed. The total labor cost will not exceed $12,000 per year, which is roughly 86 cents per million gallons on designed flow, or something over one dollar for present flows of approximately 2.5 M.G.D. Other items of the operating

General View of the Joint Plant of Rutherford, East Rutherford and Carlstadt, N. J.
(For identification of units see Flow Diagram.—Photo by McLaughlin Air Service.)

costs will greatly depend upon factors which cannot be determined at the present time.

General Description of the Plant, and Interceptors

The plant is located on a 21 acre area situated in the southeast corner of Rutherford, on the east side of State Highway Route No. 2, away from the built-up area of the Borough. A deep gravity trunk line, 7,000 ft. long, was constructed to intercept the existing outfall sewers. In order to keep the infiltration at a minimum, 10 ft. instead of the usual 4 ft. long reinforced concrete pipes were laid, and both the inside and the outside of these pipes was coated with a bituminous waterproofing compound.

Provision was made to properly meter the sewage at various points so that the volume contributed by each municipality can be determined for arriving at the equitable allocation and distribution of operation and maintenance expense. For this purpose four meters were installed on the intercepting trunk line. These are all of the Schofield Impact Flume type, and the master-meter measuring the combined flow at the plant is of the Parshall Flume type.

Although the designed capacity of the plant is only 4 M.G.D., pumping facilities are provided for double this rate, which may be put through the plant for short periods.

The site of the plant is an old marsh, covered with garbage, rubbish and other debris. For this reason piling had to be used to support all the heavy structures. An old septic tank, part of the former Rutherford Sewage Treatment Plant, was revamped so as to serve as primary and secondary clarifiers. To do so a cross wall was constructed at approximately the center point and inlets provided to admit flow which then travels to the opposite ends of the original structure. (See flow diagram.) Either of the two sections of this tank can be bypassed by means of suitably arranged stop-gates. By this arrangement, if the primary section requires draining for any cause, the secondary section will serve as the primary clarifier with but a few simple manipulations.

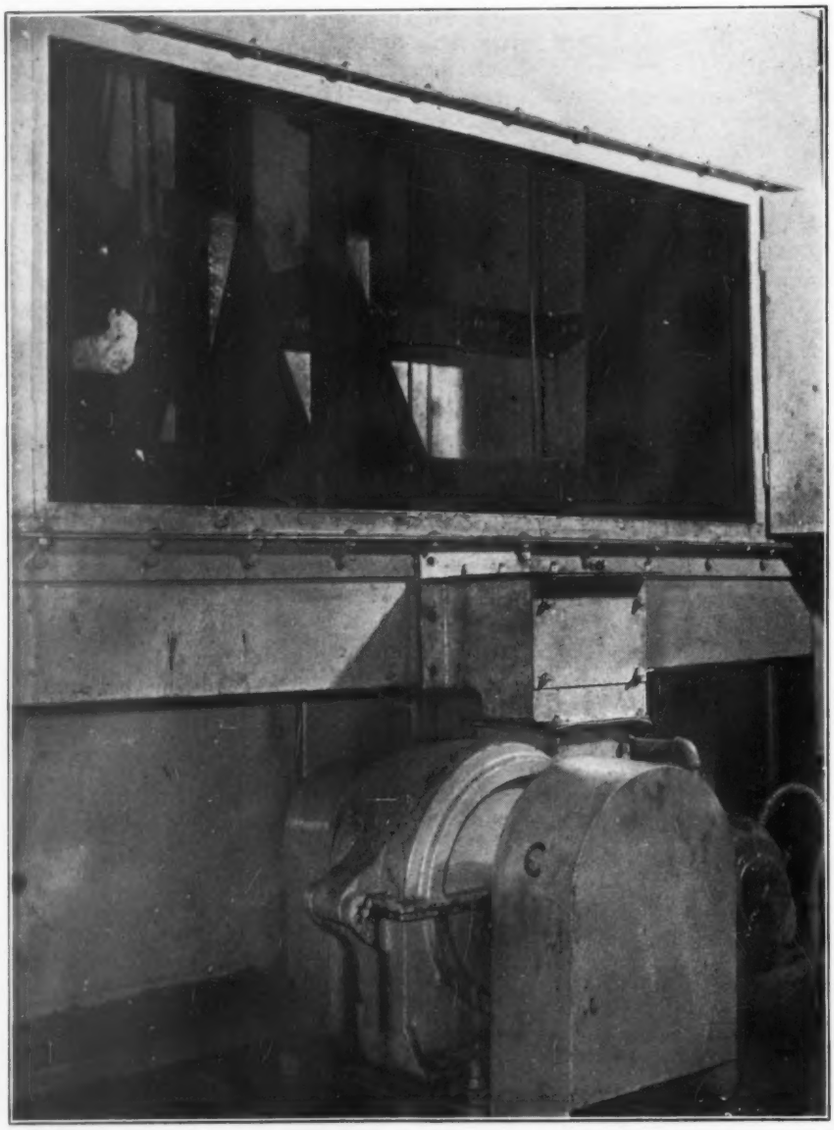
Following sedimentation, the principal treatment devices are the four trickling filters followed by an automatically cleaned mechanical sand filter. While the flocculators provide continuous mechanical flocculation, chemical treatment is kept in reserve for the event that the trickling filters prove to be insufficient to handle the highly variable industrial load. The chemicals are introduced into the sewage at the flash mixer, and the flocculation proper takes place in two paddle type flocculators.

The primary clarifiers are preceded by modern mechanically cleaned bar screens and grit chambers provided with a collector and grit washing unit. The sludge collectors in both primary and secondary clarifiers are the new "Monorakes," recently introduced by the Dorr Co.

The secondary clarifiers are followed by two mechanically cleaned (concentric) silica sand filters, which have many interesting and novel features. No separate chlorine detention tank is provided, since the chlorine is fed into the influent of the secondary clarifiers, or into the mechanical sand filters as conditions may indicate.

In order to successfully use these treatment devices, special care was taken to so interconnect them that they can be operated in a flexible manner. This was accomplished by means of bypasses (1) around the flash mixer and flocculators, (2) around the trickling filters, (3) around the effluent sand filters. And, as already stated, sludge may be sent direct to the vacuum filters, if for any reason necessary or desirable, rather than to the digesters. Also the primary clarifiers may be bypassed and primary treatment given in the secondary clarifiers.

The method of sludge disposal is such that, as previously mentioned, all contingencies have been considered. In this regard an interesting feature of the multiple hearth incinerator is that it can be used as a dryer whenever desirable to do so. A bagging machine is provided for the disposition of fertilizer in salable form.



Gruendler Screenings Grinder.
(The Doors Are Open to Show the Tops of the Bar Screens.)

The Administration Building is an up-to-date, modern structure. It contains the offices, meeting room for the Commission, the laboratory, the wash room and showers, the bar screen and sludge pumps, the chemical feeders and the chemical storage room, the vacuum filters and accessories, and the sludge incinerator. The compact laboratory is one of the best equipped in the State.

The consulting engineer was especially anxious to reduce maintenance costs by insisting on first class painting throughout and by using gratings and stop-gates of aluminum or other corrosion proof metals where required.

The plant grounds are to be elaborately treated with fine landscaping, lawns, trees and shrubbery, to make the whole not only a well designed plant but an attractive one in which the communities served can take just pride.

The Various Units of the Plant

Bar Screens and Grinder

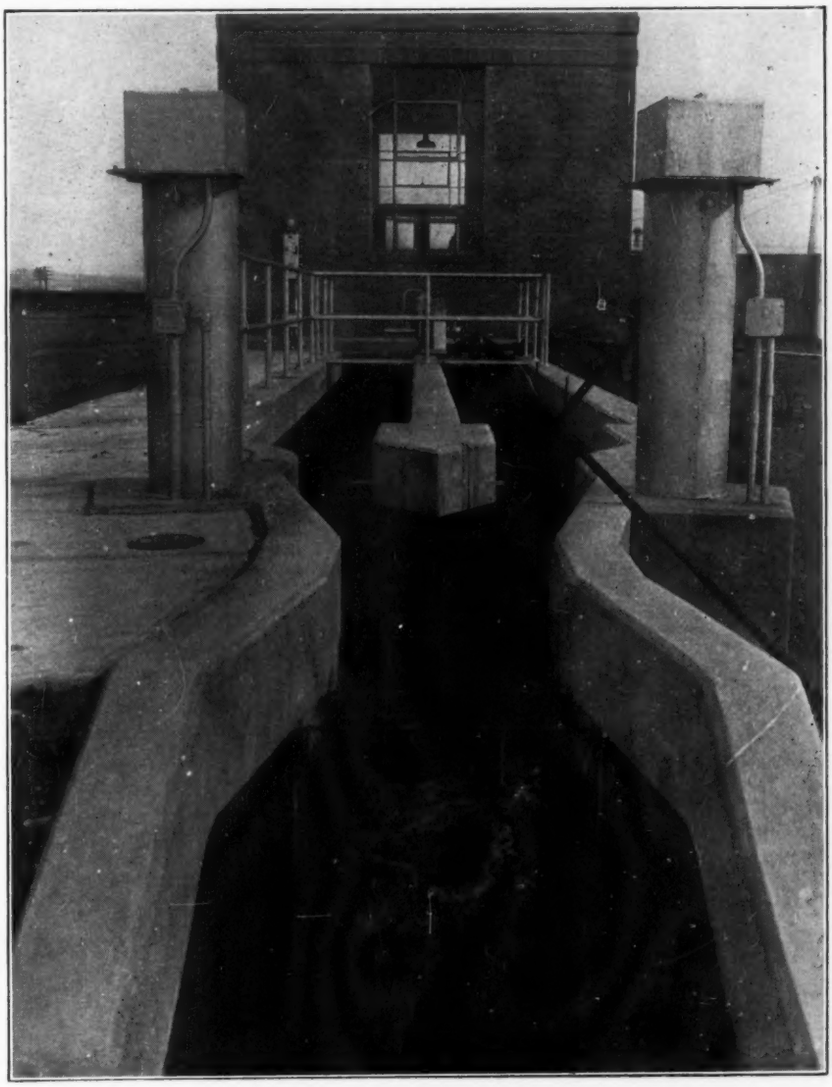
The incoming sewage first passes through two vertical Link-Belt bar screens, each 3 ft. wide, with 1-in. clear openings. The channels leading to these screens can be closed off with stop planks so that either one of the screens can be taken out of operation for repairs. The screens are mechanically cleaned by means of rakes, and the frequency of operation is automatically controlled by time switches. In addition to these switches, an emergency float operated switch is installed which starts both cleaning rakes immediately when the level of the sewage in front of the screens rises above a selected maximum elevation. The screen room is separated from the rest of the building and it is ventilated by a roof ventilator.

The screenings are fed manually into a Gruendler screenings grinder of the hammer-mill type which returns the pulped material to the incoming sewage.

Primary Sewage Pumps

From the screens the sewage enters the primary wet well; this well is divided into two compartments to facilitate cleaning. Four Fairbanks-Morse horizontal, centrifugal pumps are provided, one 1 M.G.D. and one 2 M.G.D., and two of 4 M.G.D. capacity. They are electric motor driven, with exception of one of the 4 M.G.D. pumps, which is powered by an F-M gasoline engine, and is operated only in case of power failure.

The pumps are controlled by two Automatic Controls Co. multipoint switches. The first is for normal operation, the second for emergency if the first float switch fails. If the power supply stops, or if the flow exceed 7 M.G.D. as the total capacity of the three electrically driven pumps, the second unit causes the gasoline engine to come into service. It also operates a low and high water alarm to warn the operator at the same time.



Grit Channels and Parshall Flume.

(Collecting Flight Delivers to Link-Belt Washing Screw Inside the Grit House. In the Foreground Are the Flume Stand-pipes Equipped with "Chronoflow" Indicating and Recording Units.)

Grit Chambers

Two channels are provided, either one capable of carrying the full designed flow. They are 58 ft. long and 3 ft. wide. The depth of the water is regulated by hinged gates so that the optimum velocity of flow is obtained. The channel normally in use is cleaned by a Link-Belt grit collector and grit washing element of the screw conveyor type, which discharges washed and drained grit into disposal cans. Provision is made to install a similar equipment in the other channel as soon as conditions warrant it. The grit is clean enough to be used on fills.

The grit-collecting cans are lifted by means of a hoist onto trucks for final disposal. The screw conveyor is located inside of the building to prevent freezing in cold weather. Provision is made for draining both of the grit channels and ease of washing down the grit house at frequent intervals.

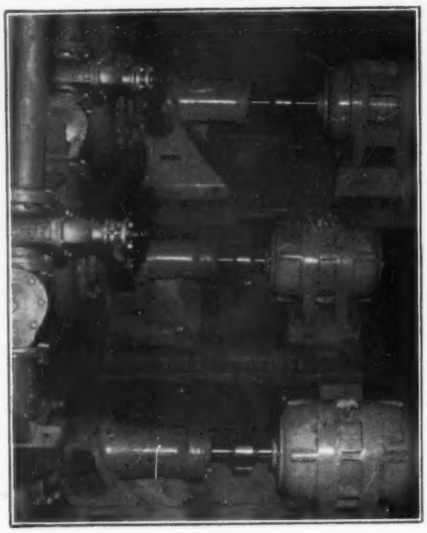
Parshall Flume

At the outlet of the grit chambers is a 24 in. wide Parshall flume for measuring the flow. It is provided with two floatwells, one for the flow recorder transmitter, the other for the transmitter actuating the regulation of the chemical feeders. Both are Builders Iron Foundry "Chronoflow" units.

Flash Mixer and Flocculators

The flash mixer of the Link Belt type is a revolving propeller installed in a rectangular chamber (6 ft. 2 in. x 6 ft. 2 in.), having a water depth of 10 feet. The chemicals are applied at the bottom of this chamber and the flow is directed upward. The speed of the mixing propeller can be varied between 43 and 128 rpm. The flash mixing chamber can be bypassed if so desired.

The two flocculating chambers are 60 ft. x 10 ft. each, with 9 ft. 3 in. water depth, providing a detention period of 30 min. at the 4 MGD designed rate of flow. They are provided with Link-Belt paddle type flocculator mechanisms, with the shafts of the paddles parallel to the direction of the flow. The speed of the paddles is 1.1 to 3.3 r.p.m. on the inlet and 0.8 to 2.4 r.p.m. on the discharge end. The chambers can be operated in parallel or in series; in the latter case the speeds of the paddles can be so changed that they decrease as the flow progresses through the units. The paddles are provided with rubber squeegees to fully sweep the bottoms of the tanks for the prevention of sludge accumulation. Drains are provided to permit the full emptying and thorough cleaning of each unit.



Pumps.

(Three of the Four F.M. Pump Units Handling Screened Sewage. The Fourth Is an Emergency Gasoline Engine Driven 4 M.G.D. Unit. Three More Units, Not Pictured, Lift Settled Sewage to the Filters.)

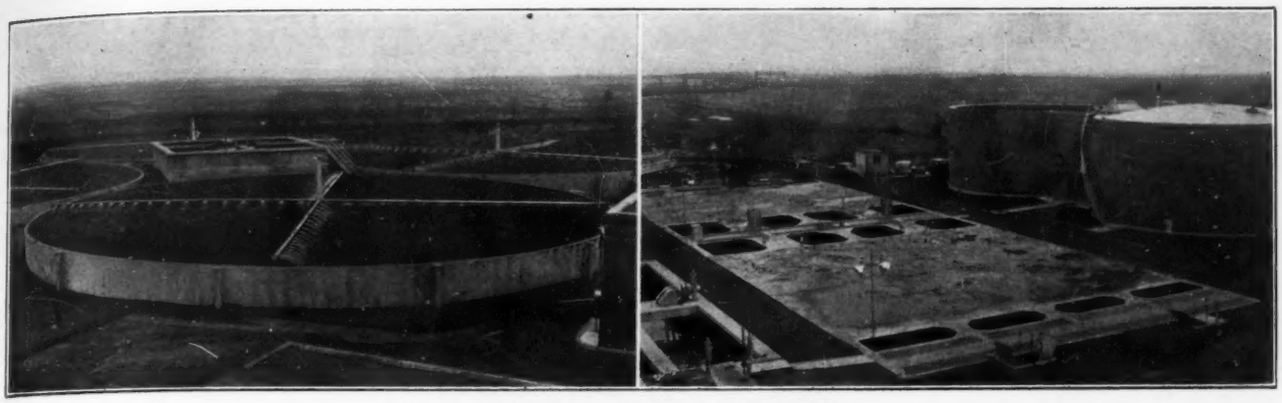
Primary Clarifiers

Twin primary clarifier units have been constructed by making use of one half of the old septic tank (see flow sheet). Each is 84 ft. 6 in. long, 27 ft. 10 in. wide, with a side-water depth of 10 ft. 3 in., giving 2¼ hr. detention at the designed rate of flow. The rate of overflow is 850 gals. per day per sq. ft. Both units are provided with the new Dorrco "Monorake" sludge collectors, unfortunately not visible in the plant pictures because of the tank covers. The great advantage of this new type collector is that it can be adjusted or serviced without draining the tank more than half way down. In addition, this type of collector requires less power for its operation than other better known types.

The raw sewage reaches the clarifier through a 36-in. cast iron pipe which empties into a distributing channel. The head of this channel is provided with a series of regulating stop plates so that the flow can be diverted into either one of these

Link-Belt Flash Mixer and Flocculators.

(The Flash Mixer Is in the Foreground. Note the Type of Plant Lighting Provided.)



Views of Plant from Administration Building.

(In the Right Foreground Is the Old Septic Tank Converted to Primary and Secondary Clarifiers. The Dorrco Monorakes Operate Beneath the Roof.)

tanks, or can bypass them entirely and flow into the secondary clarifiers if ever expedient to use these as primary units.

A special feature of these clarifiers is a patented scum valve, invented by Chas. J. Kupper, consulting engineer. By means of rotary valves, this device skims off the scum into a pipe line leading to the sludge digestion tanks, and returns the clear liquid through a baffled well into the effluent channel.

Secondary Sewage Pumps

The purpose of these pumps is to convey the effluent from the primary clarifiers into the dosing chambers. As mentioned before, the primary and secondary clarifiers were built in the old septic tank, and, as a consequence, the hydraulics are such that the settled sewage has to be lifted to the trickling filters. Two 2 M.G.D. and one 4 M.G.D. Fairbanks-Morse pumps are provided, similar to the primary sewage pumps. They are all driven by electric motors. The two automatic controls multipoint float switches controlling these pumps are similar to those of the primary pumps.

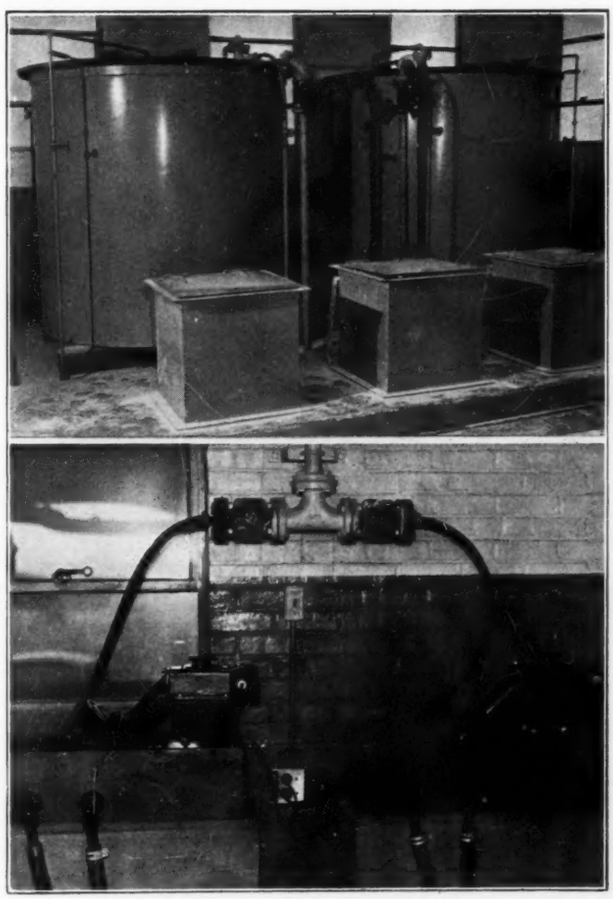
Dosing Tanks and Sprinkling Filters

Four dosing tanks are provided, each 20 ft. x 20 in., and 1 ft. 2 in. between low and high water levels. One dosing tank is provided for each trickling filter and they are fed from a common well. Any one or more can be closed off.

The capacity of the Yeomans dosing siphons is 1,450 gallons per minute each, against a maximum head of 36 in., in other words each siphon is capable of handling more than one-half of the designed flow.

Each filter has a diameter of 110 ft. 6 in. (0.22 acre area), and an effective depth of 8 ft. 2 in. The entire floor of the filter is overlaid with Armcre type self-ventilating drains supplied by the Bowerston Shale Co. This bottom, together with the 10 in. ventilating stacks installed on the periphery of the tanks, permits a thorough and efficient ventilation so important for the successful operation of these filters.

Each filter bed is fed by a Yeomans-Simplex four arm distributor, of the reaction type, in which the rotation of the arms is caused by the head of the water on the filter nozzles.



Ferric Chloride Tanks and Feeders.

(Forty Per Cent Ferric Chloride Solution Is Diluted to 15 Per Cent in the Rubber-Lined Tanks. Located on the Floor Above the W. & T. Solution Feeders Below. All Chemical Lines Are Equipped with Saunder's Valves of the Pinch Diaphragm Type.)

Secondary Clarifiers

The two secondary clarifiers are located in the southerly half of the old septic tanks. They are 8 feet shorter than the primary clarifiers; the other dimensions are the same. The detention period at the designed rate of flow is 2 hours, and the overflow rate is 930 gallons per day per sq. ft. If the sprinkling filters are not in use, the primary clarifiers are bypassed and these clarifiers serve in their place.

The sludge and scum collectors of the Monorake type are identical with those in the primary clarifiers.

Effluent Sand Filters

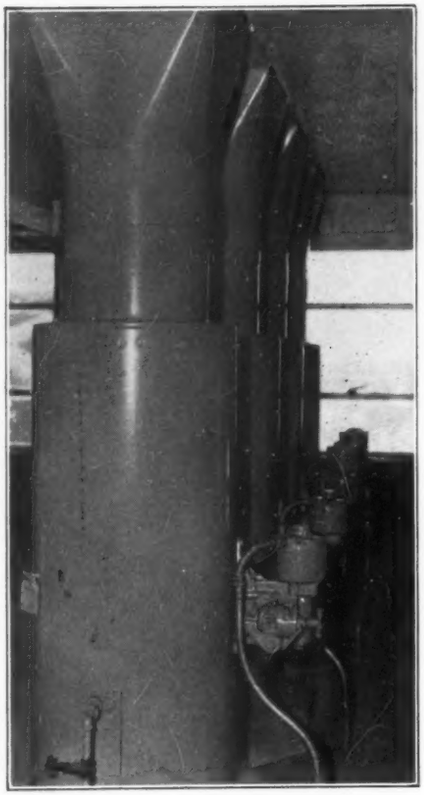
The effluent sand filters are of the Municipal downflow type, the silica sand being automatically cleaned by means of a row of hydraulic ejectors traveling through the sand bed. The filters consist of two concentric beds, of a total area of 2780 sq. ft., and operate at the rate of 1½ gallons per sq. ft. per min. at the designed rate of flow. The sand bed, which rests on a slotted bronze screen, is 5½

inches deep. The cleaning mechanisms are automatically operated, either from a float operated switch or from a time clock. The float control functions under normal operating loads; whereas, when flow is at abnormally low rates the time-clock control becomes automatically operative.

The cleaners of both beds are suspended from the same rotating bridge, the reason therefor being a resultant power saving, economy of structure and operating advantages in general. The ejector units are automatically lifted out of the sand beds when operation ceases for any reason, intentional or otherwise. This feature permits independent operation, according to flow, and allows maintenance work on either of the beds while the other unit continues to operate at a temporarily higher rate.

Sludge Digesters

The sludge digestion tanks are of the Dorr "Multidigestion" type. They consist of two units, a primary tank with a stationary cover and a secondary tank with a gas holding floating cover. The primary tank is heated normally to 90° F. and is provided with a Dorr "Turbomix" unit. Both tanks are 50 ft. in diameter, the primary with 34 ft., the secondary with 32 ft. 6 in. side water depth. The capacity of the tanks is 3.5 cu. ft. per capita for the estimated actual future population, and 2.0 cu. ft. per capita if the population equivalent in the form of industrial wastes is computed.



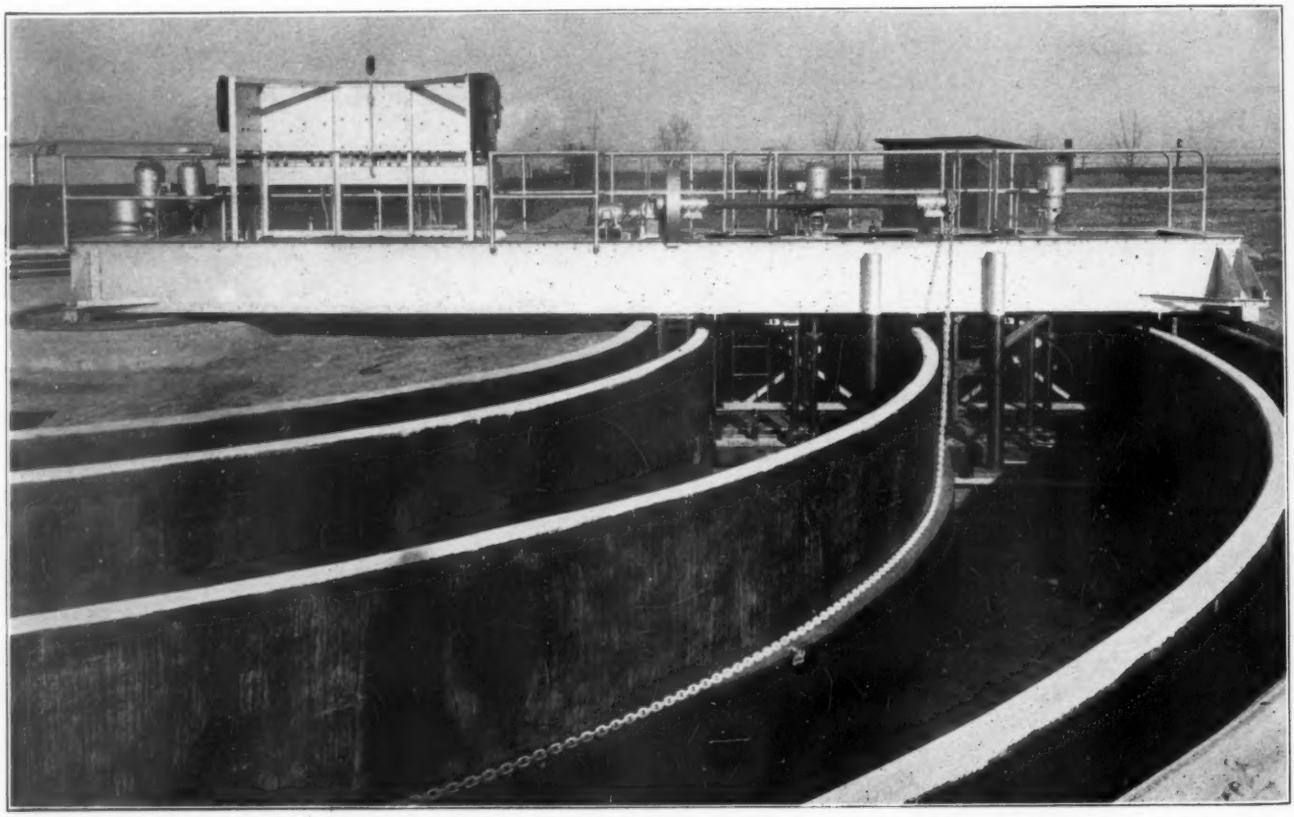
Battery of W. & T. Dry Feeders.
(For Sewage Treatment and Sludge Conditioning.)

The control and operating chambers, located between the two tanks, contains the sludge pumps, the heating plant, the gas control and metering devices, a lime feeder for pH adjustment of digester contents, the control piping for discharging the supernatant liquid and the digested sludge, also the sludge and supernatant sampling pipes. Two adjustable stroke Carter sludge pumps are provided, each having 8400 gallons per hour maximum capacity.

It is expected that more than sufficient gas will be generated to heat these tanks. The surplus will be used in the sludge incinerator and in the laboratory.

Vacuum Filters and Sludge Conditioning Equipment

Two Conkey vacuum filters are installed in the Main Building to filter digested, raw primary, or raw secondary sludge. They are 8 ft. in diameter, 8 ft. face length, with a surface area of 200 sq. ft. each and with a maximum drum submergence of 25 per cent. They are the conventional scraper type and are equipped with all the auxiliary appurtenances, such



Mechanical Sand Filter of Unique Design for Effluent Polishing.
(Note Traveling Bed-Cleaning Mechanisms Suspended From Single Revolving Bridge in Two Concentric Annular Down-flow Filters.)

as sludge pumps, dry vacuum pumps and filtrate pumps, blowers, filtrate and vacuum tanks. The filters are guaranteed to produce a filter cake of 70 per cent moisture content at the rate of 5 lbs. of dry solids per hour per sq. ft. from digested sludge, or 4 lbs. from raw sludge.

The two vertical sludge mixing tanks, with Goodyear rubber linings, have conical bottoms to rapidly mix the conditioning chemicals with the sludge. The dry vacuum pumps, having a capacity of 400 cu. ft. per min. each, are of the reciprocating type, with watercooled cylinders and forced lubrication. The capacity of the Duriron centrifugal filtrate pumps is 50 gpm. each. Roots-Connersville blowers deliver 60 cu. ft. of free air per minute and are provided with an air filter and air receiver.

The weight of sludge cake delivered to the incinerator is measured by a Merrick Weightometer, which indicates, records and totalizes the weight of sludge cake produced up to 100 tons per 24 hrs.

Sludge Incinerator

The sludge incinerator is of the Municipal multi-zone, multiple hearth type provided with a 75 ft. high stack and all the other customary appurtenances, such as cooling air fan, combustion air blower, oil pumps, combined oil and gas burners and sluicing type ash handling equipment.

The incinerator proper, with an outside diameter of 10 ft. 3 in. and 6 hearths, has a rated capacity of 35 tons of dry solids per 24 hrs. It is designed so as to conduct the moist gases (originating in the drying zone) through the hot burning zone. This deodorizes the gases and at the same time cools the hot ash. The power consumption of this unit will be very little—namely, 6 to 7 K.W.H. per hr. at most.

Chemical Feed Equipment

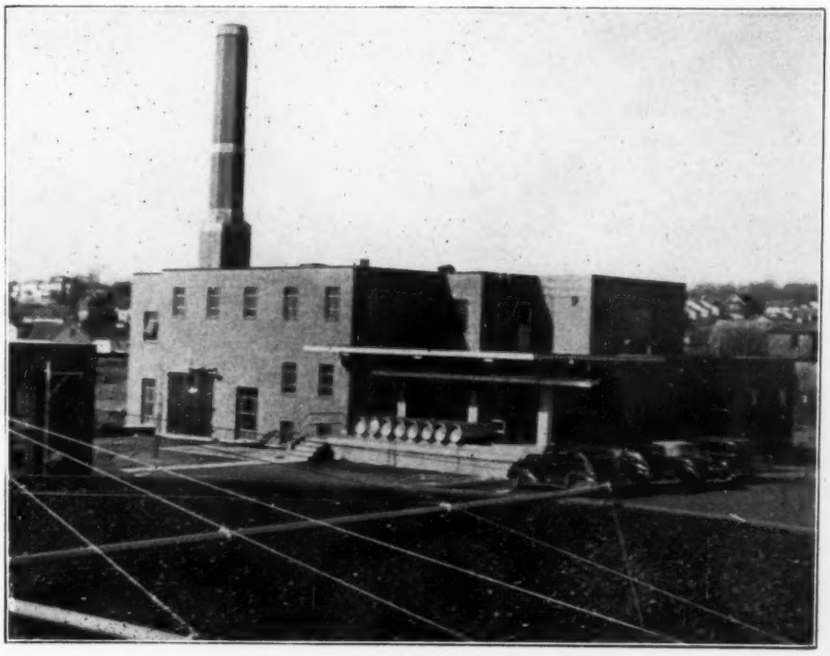
Chemical treatment will consist of pre and postchlorination, chemical precipitation of the industrial waste containing sewage, and the conditioning of the sludge both for digestion and filtration.

The chlorinators are located in their separate room in the Main Building. Each has a maximum capacity of 400 lbs. per 24 hrs. The chlorine is purchased in one ton containers and proper facilities are provided to handle these bulky units without difficulty. The prechlorinating unit is automatically regulated by the new potentiometric control system recently perfected by the Wallace and Tiernan Co. The rate of feed is proportionate to the total chlorine demand at all times, and this takes into account the flow plus the changing demand in pounds per million gallons.

The Newest in Chlorinating Equipment.

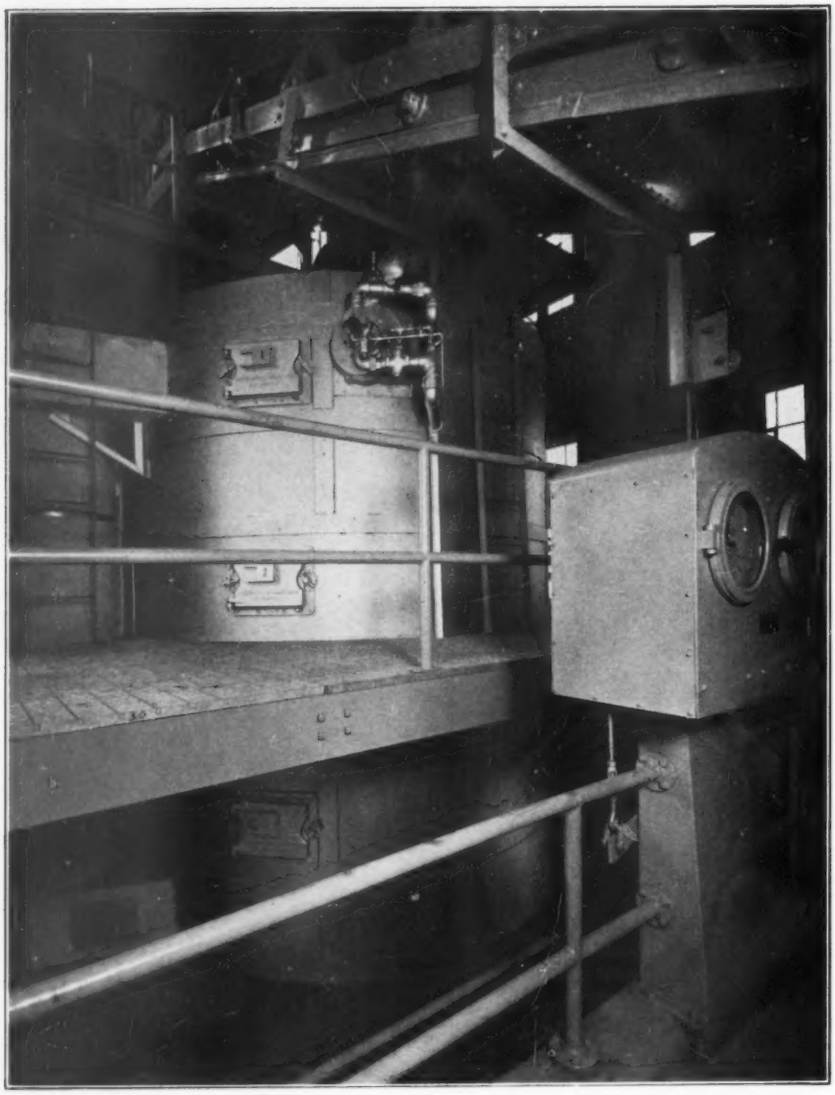
(Two 400 Lb./Day W. & T. Chlorinators Provide Pre- and Post-Chlorination. The New W. & T. Potentiometric System Controls the Pre-Chlorine Dosage Which Is Essentially for Odor Control and Enhancing Flocculation. The Potentiometric Control Unit Is in the Center. Changes in Feed Rates Are Recorded Continuously. The Post-Chlorinator Is Manually Controlled Because of Uniformity of Effluent Quality and Dosing at the Secondary Clarifier Inlet.)

The postchlorinator is of the standard, manual type. The purpose of prechlorination is primarily for odor control or to assist chemical precipitation, and to maintain the sewage free of hydrogen sulphide during its passage through the plant. Due to the varying character of the sewage, caused by the industrial wastes, the rate of chlorine feed changes quite frequently. The installation of this new method of control appears



Rear View of Main Building.

(Showing Storage Platform and Monorail System for 1-Ton Chlorine Containers. Ferric Chloride Storage Tank Is Beneath Platform.)



Municipal Multi-zone Multiple Hearth Furnace and Merric "Weightometer."
(Furnace May Be Operated as Sludge Dryer or as Incinerator at Will. In Right Foreground Is the Merric Indicating and Recording "Weightometer" Which Keeps Accurate Records of Sludge Cake Output.)

to be a practical success as well as an excellent investment. Postchlorination can be applied at the influent of the secondary clarifier or at the mechanical sand filter. The latter has to be temporarily dosed heavily on occasions to preclude bed growths and the possible decomposition of retained solids during the warmest periods of the year.

For chemical precipitation of the sewage and the conditioning of sludge, five Wallace and Tiernan dry feeders and two solution feeders are provided. Four dry feeders are located in the Main Building and one in the Digestion Control Chamber. Of the four units, two are for coagulation of sewage and their rate of feed can be automatically controlled by means of the Chronoflow transmitters installed at the Parshall flume. One of the automatic feeders is a lime feeder with a maximum hourly capacity of 50 lbs. of hydrated lime, and the other is a coagulant feeder with 90 lbs. per hour maximum capacity. The two other dry feeders are of the manual control type for the conditioning of sludge preceding vacuum filtration. One has a maximum capacity of 100 lbs. of hydrated lime per hour, and the other a capacity of 50 lbs. per hour. For feeding alum the smaller machine, with a capacity of 90 lbs. per hour, may be employed if desired.

The feeder installed in the sludge digestion control chamber is a manually controlled lime feeder, with an hourly capacity of 50 lbs. Both solution feeders are for the handling of ferric chloride solution, at a maximum capacity of 2,000 gals. per 24 hrs. each. One of them is for the coagulation of sewage and its rate of feed can be automatically regulated by the Chronoflow, the other is for the conditioning of the sludge and is manually controlled only. An accompanying photograph shows these two feeders side by side.

Ferric chloride is received in liquid form (40 per cent solution) from the Pennsylvania Salt Mfg. Co., and from Innis, Speiden and Co. It is stored in an underground, Goodyear rubber-lined steel tank, of 10,000 gals. capacity. It is pumped from storage by airlift into two 1,000 gal. dilution tanks, which also are rubber-lined steel tanks. Ordinarily the 40 per cent solution is diluted to contain 15 per cent $FeCl_3$ for feeding and flows by gravity into the feeders. The method of handling this corrosive chemical is unusually simple in this plant and the price delivered (2½ cents per lb. on an anhydrous ferric chloride basis) makes its use very economical.

A Burwak freight elevator is installed to raise the dry chemicals from the street floor level to the chemical storage room, located on the second floor over the chemical feeders.

Centralized Control

As earlier stated, the plant was designed for as much in the way of automatic operation as seemed practical. By the same token labor saving and safety centralized control has been provided as a distinct aid in operation and protection of electrical driven equipment at scattered points.

In the sludge filtration and incineration room we have something of an "operating bridge" from which a full view of all operating equipment is had. On the "bridge" is a Clark Controller Co. dead-front centralized control panel, which is pictured with this article. This panel contains thermal circuit breakers, start and stop push button stations and on-off switches for the operation of combination across-the-line starters on 22 drive motors. Also on this panel is a Republic Indicator and a Leeds and Northrup Indicating Recorder for use in regulating sludge dewatering and incinerator operations. Each piece of equipment on the panel has a name plate designating the particular operating unit which it controls.

The six electrically driven sewage pumps are controlled from another station through six Clark combination across-the-line starters. Normally the operation of these starters is automatically controlled through an Automatic Controls Co. multi-con-

tact float switch equipped also with high and low water alarms. The motor starters consist of a 3 pole thermal type circuit breaker, or a 3 pole non-fusible main line switch, a 3 pole across-the-line starter and a duplex thermal overload relay. Each is equipped with a start-stop push button, or a hand-off automatic switch so that each motor can be operated from the machine or from the central control panel at will.

The starters for the six sewage pumps (two others are gasoline engine driven) are each equipped with a time delay, no-voltage relay for motor protection should the voltage go off the line for more than 3 seconds. If such happens the circuits to the starter coils are opened and automatic control becomes inoperative until the relays are reset by hand. This arrangement also prevents the possibility of all six pumps cutting in at one time to create power line disturbances.

Independent Water System

In order to save the cost of pure drinking water in various applications, two Fairbanks-Morse 100 g.p.m. centrifugal pumps were provided to pump plant effluent into a 3,000 gal. pneumatic storage tank under 50 lbs. pressure. This supply of sand filtered effluent is employed for washing up the building, operating the ash sluicing equipment, the chlorinators and chemical feeders.

Office and Meeting Room, Wash Rooms

A generously proportioned office is available for the use of the superintendent, and a meeting room is provided on the upper floor for the Board meetings, together with an office where the records are kept. The wash rooms are exceptionally large and they are well equipped with lockers and showers. Every effort was made to imbue the operating personnel with a sense of cleanliness, so important for the successful performance of their duties.

Laboratory and Operating Results

A complete chemical and bacteriological laboratory occupies part of the main floor of the Administration Building. This laboratory is unusually well equipped to run all the standard tests, including nitrogen tests, and is influential in producing economical and efficient operation of the plant. It has been in use since December 1, 1940, when full operation of the plant commenced. While the analytical data gathered are not conclusive, they are interesting and we present herewith averages of results obtained in December.

	pH	Alkalinity (ppm)	Turbidity (ppm)	Settleable Solids (cc)	Suspended Solids (ppm)	D.O. (ppm)	B.O.D. (ppm)
Raw Sewage	7.1	204	204	8.0	226	4.4	295
Primary Clarifier effluent	6.9	...	102	trace	129	5.2	207
Trickling Filter effluent	7.4	...	35	..	32	6.6	53
Secondary Clarifier effluent	7.4	190	32	..	25	5.2	61

The average flow during the month was 2.3 M.G.D.

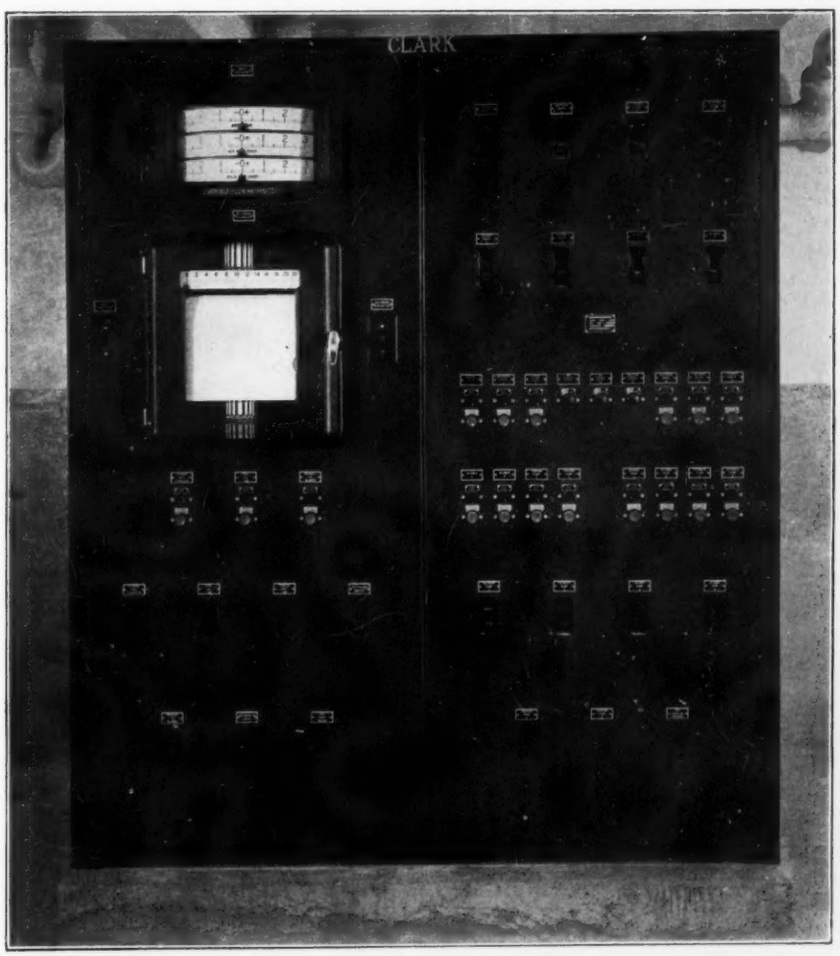
When the effluent sand filter was placed in operation it was found that it removed 50 per cent or better of the suspended solids, leaving the secondary clarifiers and a commensurate amount of the B.O.D.

At this writing the acceptance tests are still in progress. They will probably be completed in the early Spring and then the plant will be turned over to the operating body to fulfill the function for which it was created. The operating body consists of a chairman, a vice chairman, a secretary and a treasurer. Mr. John W. Petrie, Mayor of East Rutherford, is the chairman at the present time, and he is ably assisted by Mr. Martin P. Nelson, Mayor of Rutherford, as vice chairman; Mr. Frederick V. Hugo, former Mayor of Rutherford, as secretary, and Mr. William H. Nussbaum, Mayor of Carlstadt, as treasurer.

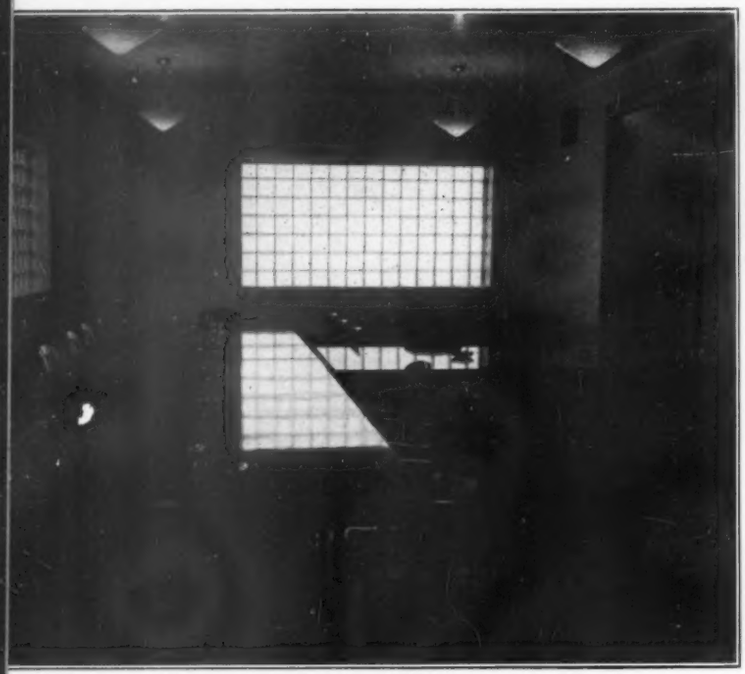
Contractors and Subcontractors

The following contractors were the successful bidders on the eight principal contracts:

No. 1—Trunk sewers, Spiniello Construction Co., Newark, N. J.
No. 2—Plant (general contract), F. H. McGraw and Co., Hartford, Conn.
No. 3—Plumbing, William Zabransky, Inc., Hackensack, N. J.
No. 4—Heating and ventilating, Westfield Engineering Co., Westfield, N. J.
No. 5—Electrical, Standard Electrical Co., Jersey City, N. J.
No. 6—Landscaping, Geo. M. Brewster, Hackensack, N. J.
No. 7—Furniture, H. L. Farkas, Newark, N. J.
No. 8—Laboratory supplies—Eimer and Amend, New York City.



Clark Electrical Control Panel.
(Permits Many Operations From a Central Control Point.)



Meeting Room of the Commission.
(Quite a Stride From Sewage Plants of Yesterday.)

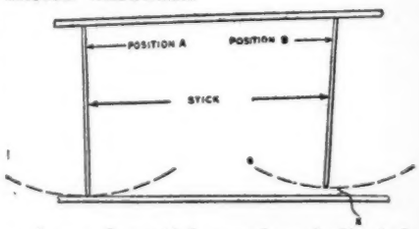
One Side of the Laboratory.
(Compact and Complete.)

Manufacturers and subcontractors supplying items of major equipment were the following:

MANUFACTURER	EQUIPMENT AND MATERIALS SUPPLIED
Allen-Sherman-Hoff Co.	Ash sluicing equipment
American Car & Foundry Co.	Lubricated plug valves
American Meter Co.	Gas meters
American Radiator Corp	Gas heated boiler
Automatic Controls Co.	Multipoint float switches
Bowerston Shale Co.	Underdrains for filters (Armcre type)
Bristol Mfg. Co.	Recording thermometers
Builders Iron Foundry Co	"Chronoflow" transmitters and recorders
Burwak Elevator Co.	Freight elevator
R. B. Carter Co.	Sludge pumps
Chapman Valve Co.	Valves
Clark Controller Co	Motor starters, switches and central control panels
The Dorr Co.	Sludge collectors, digester mechanisms
The Duriron Co	Filtrate Pump
Fairbanks, Morse and Co.	Pumps
General Electric Co.	Electric motors
Goodyear Rubber Co.	Rubber lined tanks
Goslin-Birmingham Mfg. Co.	Vacuum filters
Gruendler Mfg. Co.	Screenings grinders
Hills-McCanna Co.	Saunders-type chemical valves
Inertol Co.	Paints and waterproofing
Innis Speiden & Co.	Ferric chloride
M. W. Kellogg Co.	Incinerator stack
Kerr Concrete Pipe Co.	Concrete pipes
Kewaunee Mfg. Co.	Laboratory furniture
Kolton Electric Co.	Electric switchboard
Link-Belt Co.	Bar screens, grit collector, flash mixer and flocculator
Ludlow Valve Co.	Valves
Mathieson Alkali Works	Liquid Chlorine
Merric Scale Mfg. Co.	"Weightometer" for sludge cake
North American Cement Co.	Hydrated lime
Pennsylvania Pump Mfg. Co.	Vacuum pumps
Pennsylvania Salt Mfg. Co.	Ferric chloride
Reliance Architectural Iron Works	Structural Steel Works
Roots-Connersville Mfg. Co.	Blowers
Simplex Valve & Meter Co.	Flow meters
Thelen Bronze Co.	Aluminum grating and stop plates
Underpinning and Foundation Co.	Sludge incinerator, effluent sand-filter
Vapor Recovery Systems Co.	Flame traps and other gas equipment
Wallace & Tiernan Co.	Chlorinators and chemical feeders
Walworth Co.	Plug and gate valves
Richard Wilcox Mfg. Co.	Monorail system
Yeomans Bros. Co.	Trickling filter distributors

AN ALIGNING KINK*

An excellent practical kink for determining whether or not shafts, etc., are parallel is illustrated in the sketch herewith.



A wooden stick, used as indicated, is far better for this purpose than is a tape line or cord. Use a stick of precise length—just long enough to touch both shafts when correctly spaced as in position A. Then by moving the stick to position B or any other position, and swinging it around one end, as shown, the exact distance "x" that the shafts are out of parallel is easily measured. The correct value of off-parallel alignment is the least distance between the rod end and shaft that is observed when the rod is swung from side to side in the arc. Naturally the other end of the rod must not move from its pivot position when swinging it. This scheme works of course on horizontal as well as vertical checking and adjusting. The misalignment is then readily rectified.

In addition to shafting this scheme can be applied to any lengths of materials that are to be installed parallel to each other, rails, pipe lines, etc.

(*Contributed by W. F. Schaphorst, M.E., Newark, N. J.)

SOME PRACTICAL ASPECTS OF POROUS PLATE FILTER BOTTOMS

Based on Experiences at Larchmont, N. Y.

By HENRY T. HOTCHKISS, Ch.E.
Supervising Chemist
DEPARTMENT OF WATER AND SEWAGE,
LARCHMONT, NEW YORK

IT IS obvious that in passing down through a filter bed, water goes from zone to zone of varying function. These zones have been isolated for study in accordance with the importance of their effect on the efficiency of the unit as a whole. Thus, the surface layer has been investigated from the point of view of floc retention and effective size of sand desirable. The depth of the sub-surface layer of sand has been considered in relation to bacterial removal. The sand-gravel interface has received notice in connection with both sand support and wash water distribution. Such functional analysis is necessary in order to understand the losses of effectiveness which may arise from disruption in any of these zones and so that corrective measures may be taken.

In an otherwise quite excellent outline[1] there is found a general disclaimer for faulty design in the following statement: *"Sometimes trouble occurs in a filter bed due to local displacement of gravel. It may be that some of the large gravel has been forced upward through the fine gravel, or the fine gravel may be ridged or mounded in places. Unless the causes for such conditions are understood, the general movement may be wrongly attributed to faulty design or construction of the filter bottom."*

This, the writer believes, should not be accepted as a dogmatic statement that filter design has been perfected or standardized, but rather as an admission that improvements are needed.

Again a statement is made[2] that *"Another drawback is that although we may say filters are poorly designed, we do not have good proof of the assertion.*

"Perhaps most of us believe we know a better filter design, yet no one has produced a filter bottom in which filter beds handling various types of water have all remained in good condition. Either the ideal design has not been found or there are certain inherent weaknesses which cannot be remedied by any design of the bottom. The latter is believed to be the reason."

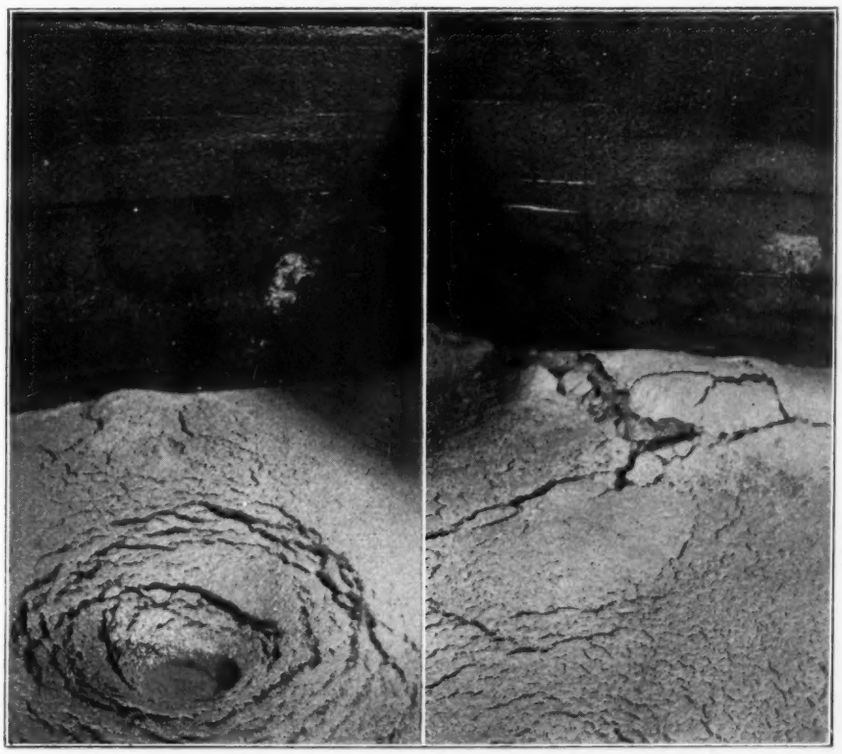
This statement should spur on investigations seeking to perfect both design and operation.

The Author

Bed Surface the "Tell-Tale"

The surface layer gives some indication of the state of affairs in the zones below. Mounds and craters are generally symptoms of internal troubles. Smaller mud-balls may be localized near or at the surface, but cracks due to bed shrinkage result from dirty sand or upset gravel. Surface washing systems, when provided, give the operator a valuable tool for improving sand conditions. They cannot, however, be expected to correct deep bed filter disruptions. The pictures (A and B) illustrate a bad case of under-drain stoppage, accompanied by gravel displacement. A clever operator, even without use of surface wash, can, by the use of rake and water jet, iron out these surface blemishes. This, however, does not correct the underlying flaws. These can only be cured by a major operation.

Depth of sand in a filter is an important item, both from a consideration of bacterial removal efficiency and clarification. It can be seen "from the geometry of the figure" that any mounding of gravel will cause a decrease in sand depth at some points as well as an increase at others. There is, unfortunately, no influence acting during the backwashing operation to restore gravel to its original graded position. This is so because those forces which move the gravel are all localized and due



Some Cause for Concern

Filter Bed Conditions at Larchmont Which Aroused Our Interest in the Possibilities of Improved Design and Eventually the Installation of Porous Plate False Bottoms and Elimination of the Trouble-making Gravel.

to high velocities created by various conditions over which the operator may or may not have control. Studies indicate that at times, when wash water is first introduced—and even when the rate-of-rise is still low—there is a tendency for the sand to expand *from the bottom* as the sand mass is lifted. Then a weakening takes place, at one or more points. Finally gravity prevails and the less dense fluid (sand-water mixture) gushes up through. The velocities of these vertical jets, coming from deep down, are of gravel moving magnitude. This may and does happen before a normal maximum rate-of-wash is reached. The fewer the points of break-through, the more violent is the local action. Washing devices, set near or under the sand surface, provide the operator with means of counteracting this tendency by creating a more fluid sand mass during the early stages of the wash. Any means of retaining the gravel layers in place will also aid in maintaining a more uniform sand depth over the filter area.

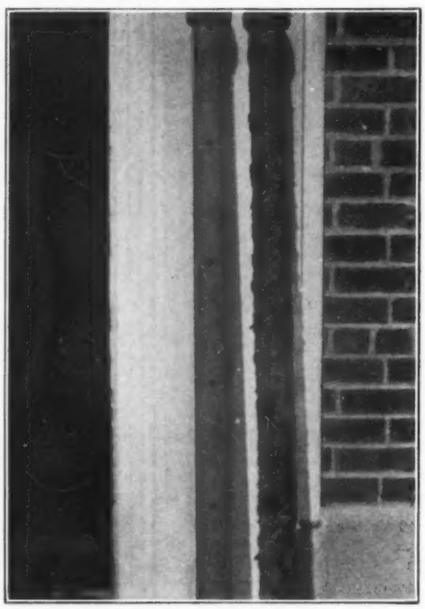
In recent years, the importance of the sand-gravel juncture has been more fully appreciated.[3] In this zone the wash water is finally distributed to the sand. The loss-of-head throughout the interface must be of constant magnitude if even velocity distribution is to be attained. Here, however, is the most unstable portion of the gravel, because the gravel approaches sand grain dimensions. The expedient of installing screens to hold down the gravel has been tried. Addition of coarse sand or fine gravel, to reinforce the gradations in this transition zone, have apparently helped in some cases.

Why the Gravel Bed?

A restatement, in simple language, of the reasons for having sand and gravel in filters would seem appropriate at this point. Sand of good quality and proper size is provided to act as a straining medium, primarily for removing the suspended matter present in the applied water. In rapid mechanical sand filters the action is physical in nature. The effectiveness of the sand bed depends, to a large degree, on proper preparation of the water and the relation of the pretreatment to the depth of floc penetration. As for the gravel, it does not seem possible to build such a substantial case of necessity. As a matter of fact, from what has been outlined previously, the evidence indicates that a good case exists for eliminating gravel from filter design. This can be done if a method of supporting the sand and distributing the wash water can be provided. The proposals of H. N. Jenks[4] and especially the studies of Professor T. R. Camp have led to the selection of manufactured porous plates for this purpose. Their use is a cure for chronic filter illness due to deep bed gravel upheavals.

The Porous Plate Bottom

Any discussion of the merits of porous plates over conventional under-drain systems has been purposely omitted since this topic has already been given some attention.[5] The mute evidence of the plugged orifices in the encrusted lateral pipe pictured herewith is submitted instead.



Condition of Laterals
Both Removed from Larchmont Filters. That on Left Has Been Cleaned.

It must be admitted that there is the likelihood of plate clogging; but because of the comparatively low initial head loss through the plates and because of the equalizing factor which exists as the less resistant pores become constricted, considerable leeway is provided before cleaning operations are required. Possibly, routine treatment of the plates by dilute acid at one or two year intervals will be found desirable. Certainly, the characteristics of the applied water should be scrutinized carefully if carbonate or other deposition is probable, so that suitable provisions may be made for protecting the plates.

Since the advent of the porous plate filter bottom there has been a conservative desire to know, in advance, just what the life of the plates will be. There is no question concerning their mechanical strength. Nor is there doubt of their ability to withstand the chemicals normally present in water and sewage, or even acid solutions of considerable strength. The question raised is a matter of performance. Will clogging take place at a rate which will nullify their usefulness? Subsequent to the provision of automatic rate-of-wash control it has been possible to secure comparative loss-of-head data.

Lachmont Experiences

The original unit, equipped with a porous plate bottom and placed in service July, 1939, in our plant, as recounted in this magazine,[5] has been in continuous use. This was equipped with piezometer tubes just above and below the plates in order to follow any changes in the hydraulic characteristics of the plates. Readings taken indicate, as anticipated, an increase in loss-of-head. An intermediate interval was also observed when the loss decreased for a time. The net result by February 21, 1941, was a total head loss through the plates of 24 inches of water. This was with a wash rate of 16.1 gals. per sq. ft. per min. (approx. 26 inch rise per min.). This head loss is not considered high. New plates showed an initial loss of four inches of water under similar conditions. The loss during filtering at design ratings continues very low.

In order to provide some indication of the effectiveness of rinsing the plates with dilute acid, the unit was cut out of service on February 21st. The following procedure was used to introduce sulfuric acid, using fittings provided for the purpose in the original installation. A syphon line, of common garden hose, was led from a crock on the filter gallery floor to the underdrain manifold. Water flowed into the crock and to the filter bottom by way of the syphon at about five gallons per min. The 66° Be. technical sulfuric acid was run into the crock at a slow rate by means of a glass funnel so that within an hour's time 81 lbs. had been used. A solution of 1¾ per cent by weight, on the basis of the acid used, was thus made and provided about 300 gals. of dilute acid. The level of water in the filter, which had previously been drawn down just to the sand, rose slowly. The water flowing through the hose was permitted to force the acid slowly up through the plates and sand for an hour.

Thereafter, wash water was introduced at a slow rate for an additional half-hour, when the water level had reached to within a foot of the lip of the wash gutters. Then the wash was continued at normal rate,

utilizing 30,000 gals. to sweep out the residual acid and loosened solids. Water was then filtered to waste until the pH had increased to the point where the filtrate had become alkaline to methyl orange. The loss-of-head through the plates was measured during the wash. It was found that this mild treatment, over a period of two and one-half hours only, had reduced the loss of head during the 26 inch wash rate to 12 inches of water, or just one-half. The cost was about five dollars.

An Air-Water Wash

The following interesting disclosure may possibly be premature, but we shall take the chance in relating it at this time. For some time since the initial plate installation in 1939, there has been the temptation to utilize the porous plate bottom as an air diffusing medium in order to obtain the scrubbing air-wash effect, particularly since the merits of this form of agitation have not been seriously discredited. It happened that the installation of rate-of-wash control in conjunction with a new steel all-welded wash water tank made it possible to introduce air along with the wash-water. And, moreover, without any cost for equipment or power. This was done by applying the aspirator principle.

A tap was inserted in the upper leg of a 12-inch tee having a 10-inch side connection to the rate-of-wash controller set between the tee and the wash water storage tank. The upper leg is normally valved off, being connected to the tank to by-pass the controller if need be at any time. The lower leg is joined to the 12-inch wash water line leading to the filters. The center line of the tee stands about 13 feet above the sand surface. By cracking the valve at the tap as the wash valve opens, adequate volumes of air are inspirated and carried by the wash water to the plates. In this way very good air distribution is secured over about two-thirds of the area of the bottom. Varying degrees of violence of sand agitation and circulation, depending upon the volume of air admitted, have been secured. By shutting down the air before the end of the wash, as is usual, the air is swept from the system by the finishing water wash.

By Comparison

As Smooth as a Table Is the Sand Surface in the Porous Plate Bottom Filter, Now in Service Since July, 1939. *Interesting Is the Combination Air-Water Wash Which This Bottom Permits.*

Thus the entire sand mass may be subjected to a thorough going-over without auxiliary equipment. This novel water-air wash procedure is possible with the rigid sand supporting medium and absence of gravel.

Adequate descriptions of porous plate installations have already appeared.[6] Certain refinements of detail and construction features which have been incorporated in the three new units provided at the Larchmont, N. Y., plant are being covered in an article to appear in "Public Works."

When the water level is drawn down below the sand in the new units, the sand surface is almost carpet smooth. The accompanying picture, in which a fairly heavy blanket of alum floc and activated carbon has been retained on the sand, is hardly a substitute for visual inspection. From an operating angle the results with the first bottom of Norton Plates have been very gratifying.

References

[1]Manual Eng. Practice No. 19 Am. Soc. C. E. (1940).
[2]J. R. Baylis, Water Wks. Eng. **93,** 1432 (1940).
[3]T. R. Camp, J. New England Water Wks. Assn. **49,** 1 (1935).
[4]J. Am. Water Wks. Assn. **16,** 542 (1926).
[5]H. T. Hotchkiss, Water Wks., & Sewerage **86,** 442 (1939).
[6]H. T. Hotchkiss, Water Wks. & Sewerage **86,** 442 (1939).
[6]H. T. Hotchkiss, Water Wks. Eng. **92,** 1426 (1939).
[6]L. R. Stevens, Water Wks. & Sewerage **87,** 111 (1940).

THE CO_2 PROBLEM IS SOLVED FOR ALL OF US*

If there is a boiler operator today who does not know what his CO_2 is, it is generally safe to say that one, two, or three unusual conditions exist, as follows:

1—His plant is exceedingly small and very little fuel is burned, so that the first cost of a CO_2 outfit will hardly be returned, if at all;

2—Or, the boiler operator's superiors are the "close fisted" variety who refuse to buy an outfit for him;

3—Or, the operator is not well versed in modern power plant practice and does not know how desirable it is always to have the RIGHT percentage of CO_2 continually passing out of his stack.

There are now so many CO_2 outfits on the market, selling at all prices from low to high, all the way from the well known orsat to the modern electric outfit that it is indeed a small plant that cannot afford one.

In other words, the CO_2 problem is solved for all of us, regardless of the size of our plant.

The Latest Device.

The latest device that has come to this writer's notice was on display at the last Power Show in New York. It does not contain any chemicals, glass or delicate parts, small orifices, ink, pens, running water, etc. Its operating mechanism consists of a standard motor and two fans which measure the CO_2 by comparing the force exerted on one fan by flue gas moving at high velocity, to that of air moving at the same velocity. Since CO_2 is 50 per cent heavier than air, the difference in weight is appreciable and when magnified by traveling at a high velocity can be indicated on a dial with surprising accuracy.

This method does not require any delicate parts and is said to be so rugged that it can be depended on to give accurate service for years under the most severe operating conditions. It indicates CO_2 continuously. A permanent record is also made for the engineer. The scale is easily read from any position in front of the boiler.

*W. F. Schaphorst, M.E., Newark, N. J. N. J.

HOW TO SECURE PRIORITY ON WATER WORKS MATERIALS

By L. H. ENSLOW
EDITOR

ON the editor's page of our March issue appeared a suggestion captioned—"Lets Not Get Excited Concerning Priorities."

This constituted an attempt at saying that, to our mind, certain material published in another magazine concerning the need for concerted action on the part of public water supply interests, in order to get Washington officials to change their attitude in respect to not issuing blanket priority for emergency water works materials, seemed to be alarming many water works managers unduly. Furthermore, that nothing had been said or done, as far as the facts disclosed, to indicate that water supply authorities would have any difficulty in obtaining repair parts and materials speedily in an emergency.

In all of the published material the Director of Priorities, as we understood him, had merely stated that a decision had been reached that issuance of a blanket priority order on water supply equipment did not seem wise or necessary. In seeming support of our interpretation of what had developed, the reply by E. R. Stettinius, Director of Priorities, to the New England Water Works Association gave adequate assurance that "specific requests arising from unforseen circumstances will be given our careful attention."

What Procedure to Follow?

Then, the next obvious question was in such cases what is the proper procedure to follow in filing specific emergency requests for priority with the Office of Production Management in Washington. On this point we made prompt inquiry in order to pass on the information to our readers. In prompt order we received from the Director of Priorities an acknowledgment and promise of a more detailed reply from Assistant Director Blackwell Smith. This now follows in full.

OFFICE OF PRODUCTION MANAGEMENT
SOCIAL SECURITY BUILDING
WASHINGTON, D. C.
March 12, 1941

Mr. L. H. Enslow
Vice President and Editor
"Waterworks & Sewerage"
New York, New York

Dear Mr. Enslow:

I wish to thank you for the stand you have taken in regard to the question of Priority for material and equipment required for public water supply utilities.

As indicated in Mr. Stettinius' letter to the Honorable Harry Irvine, Mayor of Cumberland, Maryland, it is our

PD-1

ORIGINAL

OFFICE OF PRODUCTION MANAGEMENT
PRIORITIES DIVISION
WASHINGTON, D. C.

No. _____ PRIORITIES DIVISION

APPLICATION FOR PREFERENCE RATING

Sheet One (page 1 of 4)

Instructions.—Applicant must be *the user* of the material, equipment, or service, excluding labor, hereinafter called "material." A separate application must be filed for each case presented. "Each case" means each need for specific material which can be filled by a *single* Supplier and which is for use in completing a specific contract (except as may be set forth in Par. 4 *b*). Thus, separate orders with a Supplier may be covered by a single application, if the material on each order is similar and for use in completing the *same* covering contract(s). If orders for identical material are placed with *several* Suppliers, a separate application must be filed for *each* Supplier. All information deemed relevant by the Applicant should be included in the application form; if space does not so permit, a supplemental typewritten statement may be attached. **APPLICANT WILL RETAIN QUINTUPLICATE, AND SUBMIT COMPLETED APPLICATION IN QUADRUPLICATE TO DIRECTOR OF PRIORITIES, OFFICE OF PRODUCTION MANAGEMENT, WASHINGTON, D. C. PLEASE USE TYPEWRITER.**

Date _____

1. _____
LEGAL NAME OF APPLICANT

_____
ADDRESS

_____
ADDRESS OF PLANT(S) IN WHICH MATERIAL IS TO BE USED

hereby requests issuance of a Preference Rating on the following material valued at $_____

Item No.	Name and Description of Material	Promised Delivery Date(s)
1		
2		
3		
4		
5		
6		

*REQUIRED DELIVERY SCHEDULE	1st Delivery *Date	2d Delivery *Date	3d Delivery *Date	4th Delivery *Date	5th Delivery *Date	6th Delivery *Date	7th Delivery *Date	8th Delivery *Date
ITEM 1								
Unit Quantities								
ITEM 2								
Unit Quantities								
ITEM 3								
Unit Quantities								
ITEM 4								
Unit Quantities								
ITEM 5								
Unit Quantities								
ITEM 6								
Unit Quantities								

order for which has been placed by Applicant with: (If order not placed, check here ☐ *and explain why under Par. 6 a.)*

2. _____
NAME OF SUPPLIER ON WHOM PREFERENCE RATING IS REQUESTED

Supplier's address _____

Applicant's Order No. _____ Dated _____

Delivery Dates are **arrival dates of material at Purchaser's Plant. **Installment** deliveries **must** be scheduled when **partial** deliveries will meet requirements. If necessary, delivery schedules may be attached as a part hereof.*

16—20164

general policy to limit the issuance of priorities to specific cases where defense material is involved. There is no question of not providing for the issuace of priorities to public water supply utilities—it is simply a matter of asking the water companies to comply with the general procedure which has been established for those requiring priority assistance.

You may be assured that if any water works find difficulty in procuring either materials or equipment, their application for a priority rating on the materials or equipment will receive the prompt attention of this division. Application should be made directly to the Priorities Division on forms which are provided for that purpose and which are available upon request. In the case of emergency purchases, arrangements can often be made by telegram or telephone, but this procedure should be avoided whenever possible.

Sincerely yours,
Blackwell Smith,
Assistant Director
Priorities Division

Note—The Underlining is ours.—Ed.

Upon receipt of this highly satisfactory reassuring statement we asked and received permission to reproduce it verbatin, making it public for the purpose we hope of relieving any anxiety felt by water works authorities.

We also have permission to reproduce both sides of the official O.P.M. form referred to in the letter, which is requested to be used in applying for priority rating and assistance in procuring specific materials and equipment speedily. These forms every water works manager or superintendent may obtain for possible use.

To us it is even more reassuring and seemingly settles the question permanently to note that in lieu of blanket priority delay need never be necessary as long as use of the telephone or telegraph may be resorted to in cases of real necessity. In such instances, however, it is incumbent upon the applicant to state his case and conditions briefly but clearly, in order that there may be the least delay in the message reaching the Assistant Director of Priorities—Mr. Blackwell Smith or Director Stettinius himself.

But please everyone who possibly can do so employ the application form and send it through via airmail special delivery using the telephone only when essential ahead of arrival of the filled in application form, clearly marked on its face; WATER SUPPLY—EMERGENCY.

If now, there are any questions which seem to require a further clarification we shall be pleased to receive and handle them for the benefit of all concerned.

Sheet One (page 2 of 4)

3. If Applicant has pending, or intends to file application for other material for the same product or use for which the material specified in Par. 1 is required, list for each such application:

Name of Supplier	Name and Description of Material	Date of Application

4. *a.* Supply the following information with respect to *the product* in which the material specified in Par. 1 will be used:

Name and Description of Product	Unit Quantities	Approx. Value	Delivery Date(s) scheduled in Contract(s) or Order(s)	% of Completion of Contract(s) or Order(s) specified in 4 b

If Preference Rating has been assigned to the product specified in 4 *a*, state Preference Rating ..... Certificate No.(s) ..... Unit quantities .....

*b.** Identify contract(s) or order(s) for the product specified in 4 *a;*

(1) If Applicant's customer is a governmental agency, state:
Supply Arm or Bureau ..... Contract No. ..... (COMPLETE NUMBER)

(2) If Applicant's customer is not a government agency, state:
Name .....
Address .....
Customer's Order No. ..... Date of order .....

*If numerous contracts or orders are involved, a Summary, making distinction between government and civilian orders, will suffice in lieu of answers to 4 *b* (1) and 4 *b* (2).

*SUMMARY:

c. Explain how the material specified in Par. 1 (or its ultimate use) is deemed essential to the National Defense Program. If not essential to the National Defense Program, state why application is being made:

O.P.M. Form for Use in Securing Preference Ratings for Emergency Water Supply Needs.

NEW JERSEY SEWAGE WORKS ASS'N HOLDS 26TH ANNUAL CONVENTION

Votes Not to Join the Sewage Works Federation

The Secretary
John R. Downes
Superintendent
Plainfield, N. J.

The Treasurer
Paul Molitor, Jr.
Superintendent
Morristown, N. J.

The President
Sam Probasco
City Engineer
Burlington, N. J.

Past President
Edw. P. Molitor
Superintendent
Chatham, N. J.

1st Vice-Pres.
H. Van der Vleit
Supt. Public Wks.
Maywood, N. J.

2nd Vice-Pres.
John W. Collom
City Engineer
Bordentown, N. J.

IN TRENTON, N. J., on March 20th and 21st, the New Jersey Sewage Works Association met in its 26th Annual Convention.

The most important action taken by this—America's oldest sewage works association—was the voting down of the proposal to make the New Jersey Association a member of the Federation of Sewage Works Associations. After an open meeting of discussion and airing of views by members on the question of joining the Federation, the vote was overwhelmingly against the proposal. The principal argument against the proposal was the claim that the Federation Constitution as it now stands fails to adequately take care of the small plant operator, who will be required to subscribe to the Sewage Works Journal or lose his present standing in the local association as soon as it becomes a member association in the Federation. Until the constitution is amended to permit full membership privileges of present members, permitting each to remain a member of the local association or pay the increased dues to become a Federation member and receive the Sewage Works Journal, at the pleasure of the member, the argument was strong against putting the New Jersey Association into the Federation. The present proposed amendment which has never yet been worded with exactitude but permits of Affiliate memberships in the member associations without the right of vote, was discussed and considered unsatisfactory, since it would deprive many present members from having a vote in even local affairs.

Edw. P. Decher, Purchasing Agt.
and
Leslie E. West, Chief Engr.
Joint Meeting of Elizabeth, N. J.
John Hood, Supt. Treatment Wks.
Ridgewood, N. J.

A further and extremely unfortunate argument between representatives of the Water and Sewage Works Manufacturers Association and the Executive Committee of the N. J. Association, relative to manufacturers' exhibits, led to an impasse which was not cleared up prior to the meeting.

It was these two items which resulted in the defeat of the proposal at the meeting last month, but it became quite apparent that all matters of the nature objected to by the New Jersey group are subject to correction; and, with it (it is our surmise) will come a favorable vote to affiliate with the National Federation.

In the business session it was voted to revise the New Jersey association's constitution so as to permit the establishment of Sections in various areas of the state, patterned along lines of the successful section scheme in the New York State association.

Officers 1941-42

It is customary in the New Jersey association to continue the officers for a second year. Since last year was election year, the following group of officers were re-elected for their second year:

Quiz Panel Members
Louis Fontenelli, Superintendent,
and
James F. Boreiszo, Chemist,
Rahway Valley Treatment Wks., Rahway, N. J.
M. S. Kachorsky, Supt. Public Works, Manville, N. J.
(Leslie West of Elizabeth was fourth panel member)

President

Samuel R. Probasco, City Engr., Burlington, N. J.

1st Vice President

Henry Van Der Vleit, Supt., Maywood, N. J.

(1) Ed. Decher brought along Elizabeth joint meeting's spiffy new service and maintenance truck. He is here pointing out the features of this very complete unit. (2 and 3) An unusually attentive audience—but the "speaker" this time was a magician of parts. (4) Two skeptical gents—P. N. Daniels, who hired this wind-up act, and Supt. Tom Watherly of Oaklyn, N. J. (5) We liked Elizabeth Valley's custom-built truck so well that we took a second shot at it.

2nd Vice President
John Collom, Supt.,
Bordentown, N. J.

Secretary
John R. Downes, Supt.,
Plainfield, N. J.

Treasurer
Paul Molitor, Jr., Supt.,
Morristown, N. J.

Manufacturers' Exhibits Lacking

For the first time in many years the exhibit hall was void of manufacturers' exhibits. As earlier stated, they were conspicuous by their absence because of the impasse reached between the association's Executive Committee and the Manufacturers' Association. To our mind, and that of many another, both associations were the losers. The absence of exhibits was the more pronounced when reflecting on the excellence of exhibits at the 1940 Silver Anniversary Convention of a year ago.

John G. Albertson, Associate Engr., T. F. Bowe, Consulting Engr., N. Y. City
Albert E. Browne, Mayor, and Louis Milani, Superintendent, Hasbrouck Heights, N. J.

Technical Sessions

The opening paper was that by *John W. Collom,* Supt. of Sewerage, Bordentown, N. J. In it he related his difficulties with a thoroughly neglected plant when appointed to the position of plant superintendent in 1932, as the outcome of orders from the State Department of Health to the city authorities, and the requirements of the N. J. Operators' Licensing Act. At that time Bordentown's plant was found only after some difficulty with the weeds, and, seemingly, this was one New Jersey plant that had a by-pass or two.

Mr. Collom was high in his appreciation for the assistance of the State Sanitary Engineers in "getting out of the weeds" and securing many needed improvements. In 1935, with W. P. A. assistance, the old primary contact beds were converted into trickling filters, equipped with rotary arms 80 ft. across, at a cost of $75,000.

C. Geo. Andersen Supt. of Sewerage Rockville Center, L. I. (Only out-of-state guest speaker)

Harry P. Croft Chief Engineer N. J. Dept. of Health (Had some things to say and said 'em)

Mr. Collom also told of securing a water supply and many other improvements made to the plant and the grounds since, to result in a property of which the city can take some pride.

"Operating Experiences at the Joint Meeting Plant at Elizabeth," by Leslie E. West, Chief Engr., Joint Meeting, Elizabeth, N. J.

Mr. West, in a well prepared and splendidly presented illustrated talk, reviewed the many interesting experiences, troubles and corrections in the operation of the Elizabeth Joint Meeting plant, with a sedimentation capacity of 100 m.g.d. and now treating something better than 28 m.g.d. average flows, but with peak storm flows reaching 160 m.g.d. The plant provides for efficient sedimentation discharging effluent into Class "B" waters of the lower N. Y.-N. J. harbor, and sludge disposal by concentration in storage tanks and barging to sea sludge of maximum density which can be pumped through a 4,400 ft. long sludge force main. (Problems and experiences in sludge disposal at Elizabeth constitutes a topic in itself and is to be the subject of a special paper by Mr. West for publication in WATER WORKS AND SEWERAGE. The same issue will also contain papers on sludge handling experiences at New York City plants. —Ed.)

Mr. West described the plant units and recent improvements, resulting in an effluent which has brought fish back into the outfall waters. Experiences with grinding of screenings and return to the sewage was cited as a marked improvement over former smelly disposal methods. Placing a venthood, fan and stack over the screenings "Triturator" had served to materially reduce odors at the collection and grinding station. (That cleanliness was the first order of business at West's plant was evidenced by the picture on the screen. So impressed were we with the improvements in screenings handling at Elizabeth, and good-housekeeping methods, that we have persuaded Mr. West to contribute a separate article dealing with this topic alone.—Ed.)

Mr. West described improvements made to facilitate sludge concentration in the two circular holding tanks provided with floating covers. These included better liquor decanting facilities, and a means of recirculating the tank contents. In sludge thickening Mr. West finds temperature of the sludge a chief influence, a less dense sludge being possible at winter temperatures than in summer. The maximum rate of water separation occurs in the first 24 hours, 30.5 per cent by volume being the average. Longer storage improves separation too slightly to justify added expense of tanks required. The remaining problem of scum blanket of density, greater than can be pumped through the 4,400 ft. of force main, is to be solved by providing recirculation of the tank contents. For the present the addition of sewage to the

Lester Pope, Chief Operator, Hamilton Township, N. J.
George Cameron, Supt. Treatment Wks., Atlantic City Sewerage Co., Atlantic City
Prof. Harry Lendall, Rutgers University (Proud of all seven of "his boys" on the program)

(1) E. W. Gray of Builders' Iron Fdy. and R. F. Coltart of Link-Belt Co.—both from Philadelphia. (2) In the center, M. N. Stiles, Supt., Radnor-Haverford Township, Pa., and E. R. Trimble (left), Asst. Chemist, and Gordon Weist, Chief Chemist, Chester (Pa.) Sewer Authority. (3) Alex Calhoun, Chief Operator, Chester, Pa., and Roland Heacox of Barker & Wheeler, Engrs., Albany, N. Y., who designed Chester's new plant. (4) M. F. Abrams of Wailes, Dove, Hermiston Corp., and David W. Carmichael, Boro Engr., Hawthorne, N. J. (5) "Bob" Holmes and Bernard Langton, Monsanto Chemical Co., Boston, Mass.

(1) *John Kienle, Vice-President, Mathieson Alkali Wks., N. Y. City.* (2) *W. J. Schiverea, City Engineer, Freehold, N. J.* (3) *George H. Boone, Supt., Norristown, Pa.* (4) *Albert Lehmann, Supt. Treatment Wks., Hackensack, N. J. (attending his first meeting.)* (5) *Robert Homestead, Engr. in Charge of Pumping Stations, Atlantic City Sewerage Co.* (6) *W. E. Voorhees, Secy., Boro Council, Kenneth Square, Pa.* (7) *R. W. Ockerhausen of Gen'l Chemical Co., recently transferred from Chicago to G. C.'s New York offices.* (8) *E. Arthur Bell, Boro Engineer, Essex Fells, N. J. (No. 1 question propounder to the Quiz Panel).* (9) *Alan Darby, The Dorr Co., New York.*

deep scum mass is practiced to thin it to pumping consistency, which is 7 to 8 per cent solids in winter and 8 to 9 per cent in summer.

The real problem of sludge handling at Elizabeth comes from the fact that the sea barges must be loaded in 5 to 6 hours. The sludge is pumped through the 4,400 ft. of force main by centrifugal pumps under heads varying from 15 to 70 ft., depending upon condition of sludge—one pump being rated at 2,000 g.p.m. at 40 ft. head and the newer at 3,000 g.p.m. at 37 ft. head. To relieve excessive pressures when built up, compressed air is injected to clear the main of the too dense sludge and pumping resumed. Such has been the best solution to date. Now, with facilities for homeogenizing the tank contents by sewage pumped in and tank recirculation pumping, many difficulties cited are expected to be eliminated. Having barged 80,545 tons of sludge, averaging 8 per cent solids, to sea in 1940, the cost per ton for this method of disposal, including all costs from the storage tanks to sea bottom, figures 32 cts. per wet ton or $4 per ton of dry solids handled. An increase in barging rates of 9 cts. per wet ton is to raise the sludge handling disposal cost to $5 per dry ton, unless the improvements result in a lower quantity of liquid delivered with the solids to the barge.

In commenting on maintenance and housekeeping, Mr. West stated that the liberal use of the corrosion resistant "Everdur" alloys had proved an operating boon. Cleanliness and painting is never neglected, finding that it pays to repaint at certain points quarterly, and 40,000 lbs. of rusting gratings had been regalvanized just recently.

"Problems of Providing Chlorination of Atlantic City's Sewage," by George Cameron, Supt., Sewage Treatment Works, Atlantic City, N. J.

The Atlantic City Sewerage Company owns and operates the sewer system and disposal plants of Atlantic City. To provide chlorination at the main plant, located on an island, would involve transporting one ton chlorine containers by barge and again handling from barge to point of use. A pump station on the mainland delivers sewage to the plant through an inverted syphon force main. At the discharge of the syphon chlorine demand varied between 5 and 30 p.p.m. Attempts at chlorination at the pumping station proved the great difficulty of maintaining the even residual desired, and it was apparent that under pressure in the force main more chlorine was absorbed than laboratory jar tests indicated that top requirement to be.

The problem was still to avoid, if possible, the barging and double handling of ton chlorine containers from the delivery car to the plant. After a study made by engineers of the Pennsylvania Salt Mfg. Company, the following solution was provided, presenting a departure in chlorine handling in the sanitary field. In the scheme installed ton containers at the mainland pumping station deliver chlorine in *liquid form* through a 1,600 ft. line of ¾ inch extra-heavy black iron piping from the mainland supported by a trestle constructed for the purpose. The line was provided with four expansion loops and an empty 150 lb. chlorine cylinder is inserted at the ton container end to take care of expansion and contraction of the liquid chlorine. The line feeds into W. & T. chlorine evaporators at the treatment plant, the latter feeding four W. & T. Vacuum Chlorinators of 10,000 lb./day combined capacity, normally providing pre-chlorination but arranged to provide post-chlorination also if required. In prechlorination the end sought is odor control, and other advantages, in addition to disinfection.

The unique liquid chlorine supply line, passing over navigable water, had to be located on a minimum height trestle and approved by the U. S. Government. When full, the line holds 506 lbs. of liquid chlorine as compared to 1.33 lbs. of gaseous chlorine. As a safety measure, special check valves inserted in the line at the business end (the ton container end) close with any sudden

The Stacy-Trent Barber Shop Comes in Handy as a Studio.
(1) *In No. 1 chair we sit Jack Ford, Supt. of Water and Sewers at Woodbury, who serves as a leaning post for Neptune Meter's Jock Faulks and hizzoner, the Mayor of Moorestown, Fred Smith.* (2) *W. H. Stewart of Stewart Sewer Rod fame, from Syracuse, N. Y., and our "Jimmy" ——— (we won't mention his last name because you wouldn't believe it anyway).* (3) *From Seaside Heights—J. V. Van Kirk and Ed Wintergust, Chief and Asst. Operators, walked into our "studio." (Thanks, Mr. Barber, see you again next year.)*

(1) *John Rogers, Supt., Wood Ridge, N. J., and Sam Cenicola, Supt., South Hackensack, N. J.* (2) *S. M. Rusk, Supt., New Providence, N. J., and G. W. Fergusson, Supt., Somerville, N. J.* (3) *Wm. R. Lafferty, Supt., Lakeland, N. J., and J. H. Zimmerman, Supt., Water and Sewerage, Pittman, N. J.* (4) *Jas. C. Long, Supt. Utilities, Graystone Park State Hospital, Graystone Park, N. J., and C. B. Tyggert, W. & T. Co., Newark.* (5) *A. E. Franzoso, plant operator, and M. S. Kachorsky, Supt. of Public Wks., Manville, N. J.*

drop of pressure on the chlorine line, such as would happen if a break occurred or serious leak developed. Storage of 36 ton containers is provided for by a concrete platform covered by a Transite roof. Ball-bearing roller conveyors serve to transfer containers between storage and the two Fairbanks-Morse platform scales, housed in a separate insulated and fireproof building, as are the chlorinators on the island. At present the liquid chlorine is fed at a 200 lb./day rate through the ¾ inch line and the ball check safety valves are set to close if the rate rises to 3,000 lbs., which would indicate a serious leak. (This unique installation will be described in some detail in a special article to appear in a near future issue of this magazine.—Ed.)

Mr. Cameron then described other major betterments made to the Atlantic City Treatment Plant. These involve added settling capacity and conversion of old settling units to mechanically cleaned units with the new Dorr "Monorake," new sludge beds and pumping facilities, grit equipment, etc. The plant now removes 50 per cent of the suspended matter from 12.5 m.g.d. flow.

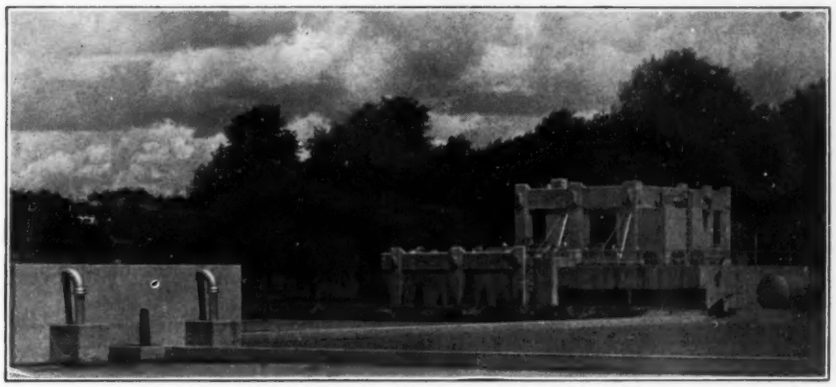
"The New Activated Sludge Plant of Livingston, N. J.," by John G. Albertson, Associate, Thos. F. Bowe, Cons. Engr., New York City.

Mr. Albertson described the $270,000 P. W. A. financed activated-sludge treatment plant of 500,000 g.p.d. and sewer improvements of Livingston, N. J.

The aeration tanks of spiral flow design are equipped with diffuser plates located 18 inches above floor and arranged for tapered air input. A sludge premixing tank, equipped with tubular diffusers, precedes the aerators to insure equal sludge ratio in both aerators regardless of flow of sewage or return sludge. In the aeration units the diffuser plates are set in concrete holders resting on aluminum supports. For tapered air control each tier of plates is subject to individual air regulation by valved control of each drop pipe.

The flow measuring device is a Parshall Flume which measures the sewage after primary settling. Primary and secondary clarifiers are rectangular, having Jeffrey mechanisms. Effluent weirs of the final tank extend along the sides and up to the cross tank weir trough at the three-fourths way point from the inlet.

The digesters, providing two stage digestion, are equipped with Dorr mechanisms and turbo-mix unit in the primary tank. The heating coils



The New Treatment Plant of Hasbrouck Heights.
Dosing tanks and sand filters in foreground produce essentially drinking water from effluent of chemical precipitation plant beyond. Thos. F. Bowe and J. G. Albertson, Designing Engineers; Louis Milani, Supt. of Plant and Sewers.

are vertical. They set in the path of moving sludge and can be removed for inspection, etc., from the roof. The secondary digester is gas-holder equipped.

Sludge return is regulated by raising or lowering a V-notch take-off located in the weir box through which pumped sludge passes, the overflow going to the crude sewage.

Blowers are of the flexible dual impeller rotary displacement type, in duplicate, and so valved to utilize either or both of the two sets of impellers to provide air in steps of 250 cu. ft., between 250 and 1,500 cu. ft. They are connected through rubber couplings to minimize hum and vibration.

Pre- and post-chlorination is provided, the ejector water supply being plant effluent, and only the tray water taken from the city supply. The plant proper cost $92,000 and is operated under the supervision of Edw. P. Molitor, Supt. of the Chatham-Madison plant.

"Activated Sludge at Rockville Center, N. Y., and How to Tame It," by C. George Andersen, Supt., Sewerage and Sewage Treatment, Rockville Center, L. I.

Inasmuch as Mr. Andersen's paper is a follow-up of papers on operation at Rockville Center, which have earlier appeared in WATER WORKS AND SEWERAGE, his present paper will be printed in full in a near future issue. On this score we will merely highlight his very informative paper, which carries much of value to activated sludge plant operators.

The axioms at Rockville Center are "the fresher the returned sludge, the less the headaches; the least water added to digesters with the sludge, the better the behavior and the less the solids in supernatant." Another axiom is to trim return sludge to the permissible minimum and to insure dissolved oxygen at all points in the aeration units, at and beyond the one-third way point; and a third is to avoid expensive nitrate production and depend on final filtration to take care of solids in the secondary tank effluent. Average effluent figures quoted by Mr. Andersen for 1940 were:

	Secondary Eff.	Filtered Eff.
Susp. Solids.	28	13
B.O.D.	44	26

indicative of results from the combination of economical use of air, limited sludge return and dependence upon a filter to remove non-settling floc in a non-nitrified effluent. The air input is tapered from inlet to outlet at Rockville Center.

To maintain fresh sludge of highest solids content obtainable, the secondary tank sludge depth is held to 1.5 ft. as the optimum productive of return sludge containing 25,000 to 35,000 p.p.m. dry solids, delivered to the aeration units to hold between 800 and 900 parts dry solids in the mixed liquor. (Later, when replying to questions, Mr. Andersen stated that 600 parts solids carried is preferable to anything higher than 1,000 parts and that 1,200 parts spelled certain trouble in the Rockville Center procedure of holding air input to the permissible minimum.)

In digester operation (85° F. avg. temp. maintained) thickened sludge is admitted daily to digesters in rotation. Lime is still frequently resorted to (in summer mostly) to consolidate the mixed crude and activated sludge to 7.5 per cent solids content. Result of the procedure of sludge thickening and maintaining 7.1 pH on the average in the digesters is a supernatant liquor of 200 parts solids, which did not affect aeration, as had the more soupy product coming from adding to the digester greater volume of cooling and disturbing thin sludge.

Mr. Andersen, relating the method

followed in keeping diffuser tubes clear of clogging, said that weekly a back-flushing was given with city water under 70 lbs. pressure to each tube individually, requiring 6 hours for the complete job.

"CO_2 as Aid to Chemical Precipitation," by John Hood, Supt., Sewage Treatment, Ridgewood, N. J.

Mr. Hood, in a paper of credible proportions, reviewed difficulties with coagulation of the Ridgewood sewage, where chemical precipitation has been practiced for the past several years to reduce trickling filter loadings and producing a plant effluent of higher quality thereby. By studious investigations the difficulty, at first assumed to be caused by industrial waste of some variety, was traced to the alkalinity increase of the sewage in hot weather. Such alkalinity increase was traced interestingly enough to root blockages in the sewers. Such stoppages created septic tank areas in the sewers and alkalinity of Ridgewood sewage increases markedly with septic action, as was demonstrated in the laboratory and by sewer survey.

Studies at the plant revealed that bubbling carbon dioxide gas through the sewage to lower the pH and reestablish the alkalinity equilibrium (carbonate-bicarbonate ratio), resulted in markedly lowering the alum dosage required and improving flocculation. In consequence the Ridgewood sewage is now gassed with stack gas from a special digester gas burning furnace. The gas is cooled, compressed and diffused through submerged Aloxite prous tubes to reduce alum consumption to about half by cutting back the alkalinity of the settled sewage to a pH value of 6, or approximately that, ahead of the coagulant dosage. Other benefits noted since introduction of the CO_2 treatment for improved coagulation has been a further reduction in B.O.D.; a lessor chlorine requirement; improved gas production; enhanced grease removal; and, strangely enough, less lime has been required to maintain proper pH of the digester contents.

As a further aid to the process of reducing the buffering effect of high alkalinity sewage, the return (recirculation) of effluent was resorted to in amount of 550,000 gals. per day.

The CO_2 producing equipment, designed by the Millard F. Smith Co. of Bloomfield, N. J., is composed of a compact, automatically controlled boiler, suited to varying rates of gas production and not served from a gas holder. Thus, in producing a stack gas rich in CO_2, the heat recovered goes to the digesters and for heated buildings.

Another equally interesting disclosure in Mr. Hood's paper was the account of root control in sewers, through the application of copper sulphate. Details of this procedure and results attained are to be the subject of a separate paper by Mr. Hood, scheduled for publication in a near future issue of this magazine. However, the following constitute the highlights of the method. The dosage of copper sulphate is added through the basement toilets in amount of 2.5 pounds per treatment. The copper salt poisons the root, which shortly decays to the extent that the weight of the "root-mop" tears loose the small feeder root which passes through the joint or crack of the sewer and the entire mass travels down sewer some 5 to 7 days later. Analyses indicate a reduction in observed alkalinity of 435 p.p.m. to the normal sewage alkalinity of 225 and pH 8.1 dropped to 7.5. Removal of such root chokages had been instrumental in relieving the odor situation at the plant by reducing sulphide content and making prechlorination more effective and at times permitting its suspension, the net savings being roughly $1,000 per year on prechlorination.

L. H. Enslow, Editor, WATER WORKS AND SEWERAGE, in complimenting Mr. Hood on the type of work conducted at Ridgewood, said that he could attest the efficacy of copper sulphate in root growth control, as it had been effective wherever properly applied. The method, first suggested by McAmis, Supt. Water and Sewage at Greenville, Tenn., was to be found in the Annual Reference and Data Number of WATER WORKS AND SEWERAGE. It seemed that a 2.5 pound dosage was considerably more than McAmis had found to be required, but Mr. Hood countered by saying that the treatment was cheap at any price and they wished to insure a killing effect, so no attempt had been made to determine the minimum.

Mr. Enslow emphasized the fact that roots most usually enter through the upper half of the pipe and, therefore, to reach the feeder root with the copper the best effect came when the sewer was full but had a trickle flow to take the sulphate down to the root. Actually, it might not be a bad idea to place a temporary low dam across the manhole down sewer and back the sewage up beyond the offending root.

As to CO_2 gassing to aid chemical precipitation, Mr. Enslow said that conception of the scheme some years back, and its adaptation at one of the Atlanta plants, should be credited M. T. Singleton, Consulting Engr. of Atlanta. The method proved effective, but the adequate cooling of engine exhaust gas was the chief problem. When one comes to think of it, digester gas is far richer in CO_2 content than stack or exhaust gas. It is already cool and far less will have to be pumped through the sewage to secure the same effect. At the same time the gas will be scrubbed free of a good proportion of its impurities and make a cleaner product for use in combustion equipment and engines. The interesting aspect of CO_2 gassing over pH adjustment with acid is that the gas seems to be automatic. For example, the greater the alkalinity of the sewage or industrial waste, or laundry waste, the more rapidly is the CO_2 taken from the gas. The most interesting observation is that at pH 6 the CO_2 demand is essentially satisfied and it is difficult to lower the value under pH 6, which fortunately seems the optimum point for coagulation improvement. So while the pH line may be of saw-tooth pattern ahead of CO_2 gassing, it comes out a mere wavering line beyond the absorption chamber without any effort to secure this desirable circumstance. It was interesting that Mr. Hood had conceived the method independently and that the results at Ridgewood and Atlanta came out so closely a parallel.

Report of Research Committee

The Annual report of the Research Committee was presented by the Chairman — Weston Gavett, who briefed the work under way in the laboratories of the N. J. Sewage Experiment Station, directed by Dr. W. Rudolfs. The following were listed as the more important investigations of the year.

Under Dr. Heukelekian investigations continue into the behavior of activated sludge and the cause and remedies for bulking of sludge. The effect of sugars and the importance of the carbon-nitrogen ratio is being further explored; also bulking by compounds other than sugars; the effect of ratio of B.O.D. of activated sludge and sewage (namely, the quantity of sludge carried in mixed liquor for given strength sewages); the method of adding air and/or sewage load to aeration units; the effect of nitrates vs. absence of nitrates.

In the latter respect the application of mineral nitrate during bulked sludge condition had taken the place of increased air input to correct under aeration.

Dr. Ingols is studying a possible tell-tale for activated sludge control. Such consists of the dropping mercury electrode for determining dissolved oxygen continuously in mixed liquor. The method, if it proves feasible, may save many an activated sludge plant from going bankrupt in regards the oxygen balance in the aeration units.

Dr. Gehm, studying means of reducing chemical demands in coagulation of sewages, finds phosphates responsible for increased chemical requirement. Methods for reducing coagulant demand show promise, and a coagulant developed (an iron proteinate) offers great promise. It comprises a combination of gelatin and iron as we understand it.

"Results from the Sewage Plants of the Raritan Valley" by LeRoy Forman, Sr. Sanitary Engineer, N. J. Department of Health, Trenton, N. J.

Mr. Forman's paper comprised an enlightening review of accomplishments of the 18 treatment plants built in the Raritan Valley in a valley-wide cleanup program. His report consisted principally of detailed tabulated data of a complete nature for all of the plants.

In summary the following table tells the story for the most part.

Type Plant	No.	Flow (Total M.G.D.)	% Reduction Averages B.O.D.	Susp. Solids	Org. Solids	Org. N.
Trickling Fltrs.	7	9	88.5	70.7	54.1	59.8
Chemical Prptn.	6	11	54.1*	77.5	48.5	35.3
Sed. + Chlorine.....	8	7	50.8	62.3	47.8	27.2

*Omitted are results from a single plant treating an industrial waste not amenable to effective coagulation, because of strong reducing compounds contained.

The Rahway Valley can now boast no untreated sewage. The several plants serving 239,775 people (plus industries) are removing 22,000 pounds of B.O.D. daily, representing the worse half, and 39,677 lbs. of suspended solids from the 26 m.g.d. flow treated in 18 plants, of which 14 are sedimentation and chlorination or chemical precipitation plants.

"Experiences with Chemical Precipitation at Hasbrouck Heights, N. J." by Louis Milani, Supt. of Sewerage, Hasbrouck Heights, N. J.

Mr. Milani after the third year of service reported on the operation and performance of the Hasbrouck Heights plant, which provides chemical precipitation and secondary treatment through slow sand filters. Pre and post chlorination is employed and the plant is designed for utilizing chlorinated copperas or alum as the coagulant. The latter being preferred, on the score of simplicity of handling, storing and feeding, is most generally used.

A rapid flash mix is followed by slow speed flocculation (2 to 3 r.p.m. of paddles) and clarification in rectangular mechanically cleaned clarifiers. Sludge is digested. The chemical effluent is distributed through a P.F.T. dual automatic syphon battery to four slow filters in rotation.

Chemical sludge (2,200 gals. daily of 4.5 per cent solids content) is pumped to heated digesters yielding 0.85 cu. ft. of gas per capita daily. Supernatant liquor return to the raw sewage has disturbed the plant to an extent that this liquor is to be disposed of separately. Gas is stored in a 40 lb. pressure tank and the sludge (digested) is dewatered on an Oliver vacuum filter, the cake being trucked away for land disposal.

Chlorine is applied up the trunk sewer to suppress hydrogen sulphide formation, and again to the final effluent—the dosages being up-sewer 6 to 10 p.p.m.; final 3 p.p.m. Alum requirement for the strong sewage (60 gal. capita) has amounted to 915 lbs. m.g. to 360,000 g.p.d. average flow, making the total chemical bill 26 cents/capita/year.

Typical operating results show suspended solids of 350 p.p.m. reduced by precipitation to 30 p.p.m. and to zero in the filter effluent. B.O.D. is lowered from 350 p.p.m. to 125 p.p.m. by precipitation and to 2 to 7 p.p.m. in the filter effluent. Chemical treatment reduces suspended solids by 85 to 90 per cent and B.O.D. by 50 to 60 per cent; therefore, the sand filters have little straining work to do but account for 40 to 50 per cent of the B.O.D. removal. Final effluent constitutes the major water supply for the plant at a material saving.

To keep the sand filters free of top-sealing a little Gravely hand tractor, such as used on estates for cutting lawns, plowing, etc., has been put to good use. It is equipped with a harrow with teeth set to scarify the bed ½ to ¾ inch down and is used on the beds about 8 times each year.

The plant, designed and supervised by John G. Albertson, Associate of Thos. F. Bowe, consulting engineer, cost $126,823. Through the construction of 1,100 ft. of cast-iron pressure sewer at the plant end costly pumping was avoided.

"Operating Experiences at the Manville Plant," by M. S. Kachorsky, Supt. of Public Works, Manville, N. J.

Mr. Kachorsky described the Manville trickling plant and 4,800 ft. Transite 10 in. sewer leading thereto.

Concerning filter operation, a spray of 3 lbs. of pyrethum powder in 5 gals. of kerosene had been more effective than flooding. The spray is diluted with water before spreading. A weed burning torch had been used to destroy flies around the edges. Ponding had not been relieved by copper sulphate application but heavy chlorination applied during low night flows (20 p.p.m. dosage) had been effective in relieving ponding, apparently due to algae growths. The filters are equipped with rotary Simplex distributors.

Digesters at Manville have floating covers and copper tubing hot water coils, which had shown some signs of pitting and leakage at the sweat joints. Sludge dried under glass is shredded for land application by a Royer Disintegrator. Prechlorination is regularly practiced for odor control and post chlorination for disinfection.

Treating 319 m.g./year, the operating cost had been $30.80 per m.g. The plant removes 90 per cent of the B.O.D. and 98.3 per cent of suspended solids.

"Sewer and Safety Equipment for Proper Sewer Maintenance" by Edw. P. Decher, Asst. Secy. and Purchasing Agent, Joint Meeting, Elizabeth, N. J.

Mr. Decher had on display the two radio equipped sewer maintenance and service trucks of the Elizabeth Joint Meeting. The newest of the trucks is a custom built job designed by the Joint Meeting staff, to carry a very complete line of maintenance and safety equipment. Aided by lantern slides this truck built by Peter Wendell and Sons of Newark, N. J., was described in some detail by Mr. Decher. Since the very complete

set of equipment carried on the trucks has already been described in Mr. Decher's article in W.W.&S. for September, 1939, and the new truck in the October, 1940, issue, scarcity of space at this point leads us to direct readers to those two articles. (Interested readers not having the Sept., 1939, or Oct., 1940, issues available will be supplied copies upon request.—Ed.)

One of the latest pieces of useful equipment added is the set of two way voice-powered telephones, over which the men in the sewer can report conditions found to the men at the manhole. Exact location of deficiencies when located can be readily recorded by distance markings on the 'phone cable. These telephones were demonstrated by Mr. Decher, as was the blower operated safety mask and harness worn by the man in the sewer.

"Effects of Trade Wastes and Solids Concentration on Sludge Digestion at Rahway" by Louis Fontenelli, Supt. Sewage Treatment, Rahway, N. J.

The Rahway Valley plant treats the sewage from 9 communities and the wastes from 35 industries, a total flow of between 9 and 10 m.g.d. The plant provides primary treatment, two-stage digestion and chlorination. Sludge is dried on open and glass covered beds.

Digester troubles, indicated by sudden dropping of gas production were traced to industrial wastes which exhibited a pH swing of 1.3 to 10.9, the acid being the chief offender in dropping the digester pH. To correct the difficulty heavy lime application (12,850 lbs.), to recirculated primary digester sludge over a 2 day period, was resorted to.

The ultimate correction was drastic, but did the job. From the two 20 ft. deep primary digesters 14 ft. of the contents were drawn off to an available storage basin. Three feet of secondary sludge was then run into the primaries and the mixture recirculated. For a period the secondaries were operated as primary digesters, adding one half the fresh solids and leaving one half to accumulate in the settling tanks. Then followed a careful control of adding fresh solids to the primaries on the basis of volatile solids ratio in the digester and fresh solids. After 23 days the digester was again full and put back in normal operation.

Thereafter sludge concentration (4 to 5 per cent solids in the ordinary run raised to 7 to 8 per cent solids) was resorted to as a means of improving digester operation by reducing the liquid input and maintaining, thereby, a greater weight of solids in the digester in order to assimilate more incoming fresh solids.

This plan, with certain alterations made to correct short-circuiting of the primary digester, is resulting in more and clearer supernatant in the secondary and a sludge of 7 to 8 per cent solids content compared with but 5 per cent originally.

Mr. Fontenelli concluded that in digester operation to full capacity efforts should be made to maintain the highest solids concentration practical in the digesting sludge in order to absorb the volatile solids input without overloading the process.

"Breaking in the Plant of Hamilton Township," by P. N. Daniels, Supervising Engr. and Lester Pope, Chief Operator, Trenton, N. J.

The Hamilton Township plant designed for 4.5 m.g.d. was described by Mr. Pope. It provides screenings shredding, sedimentation, trickling filters, separate digestion, vacuum dewatering of sludge and chlorination. It has hardly been broken in.

Sewage Information Please

(The Panel: West, Kachorsky, Fontenelli, Boreizzo)

The following are the questions propounded to this panel from the floor and the answers:

Q. What type of packing is best for a badly worn shaft or bearing?

A. **Mr. Fontenelli:** A soft packing followed by hard ring. The soft packing smokes some and solidifies. Is N.G., however, for thrust load. **Mr. West:** Suggested locating and correcting the cause. Supply new sleeves for bearing. Another method of taking care of air sucking pump-bearings was to provide a seal, employing water under 40 to 50 lbs. pressure from a separate supply system rather than from the potable water lines direct—thus avoiding possible back syphonage.

Q. Was pitting confined to copper coils at Manville or was iron work attacked also?

A. **Mr. Kachorsky:** The steel work was not attacked because of the protective coating used on the steel.

Q. What is the best method developed for concentrating activated sludge?

A. Top water chlorination while thickening in deep conical bottom units.

Q. Will return of supernatant from digesters to raw sewage increase chemical coagulant required?

A. **Mr. Bell** (Essex Fells, N. J.): Yes; however, chlorination of this supernatant has largely corrected this condition. Sludge concentration before adding to digesters will both reduce the quantity and improve the quality of supernatant.

Q. What constitutes proper ratio of volatile solids input as crude sludge to volatile solids in digester sludge?

A. **Mr. Fontenelli:** 5 per cent input should be maximum and 7 per cent is top for short periods.

Q. What in sludge creates a high chemical demand in conditioning for dewatering?

A. A variety of buffering materials, including the ammonia salts, phosphates, etc., which may be washed out by elutriation.

Q. Is there any biological action in a rapid filter?

A. **Mr. Downes** (Plainfield, N. J.): Yes, but in a backward direction. The tendency is for such filters to be reducing beds rather than oxidation units. Nitrates will actually be reduced to nitrites.

WATER SERVICE AND SEWER RENTS

The following interesting decision is reported by the Municipal Legal Information Service of the New York State Conference of Mayors and Other Municipal Officials:

"On October 11, 1940, the Court of Appeals, Richmond county, Ohio, held that the city of Mansfield had authority by ordinance and rules and regulations issued thereunder to shut off water at premises which are delinquent in their sewer rental payments. Pointing out that it is well settled that a city may shut off water for nonpayment of a delinquent water bill, the Court considers the direct question involved in this case of the power of a city to discontinue one service for failure to pay for another service, and holds that the sewer and water systems are so closely related as to be considered one transaction as the operation of the sewage system is dependent upon the water supply, therefore, it is reasonable to shut off water for nonpayment of a delinquent sewer rental bill. The court cites and relies upon the case of *Dodd* v. *City of Atlanta*, 113 S. E. 166, which reached the same decision as was reached in the instant case. *Gatton* v. *City of Mansfield.*"

—From *"Health News."*

PROTECTION OF WATER AND SEWAGE PLANTS BY EFFECTIVE LIGHTING

By ROBERT J. SWACKHAMER
Illuminating Engineering Laboratory
GENERAL ELECTRIC CO.
SCHENECTADY, N. Y.

The Author

OFFICIALS of municipally owned public services, water supply systems in particular, should not overlook the possibility of sabotage during the present world-wide emergency. Under cover of darkness or poor lighting, night sabotage is a particular hazard. Privately owned public utilities and industrial plants are recognizing this danger, and are providing protective lighting systems along with other safeguards.

A few municipally owned utilities have also awakened to the need. Plans to construct fences and floodlighting systems around all city water, light and power properties as guards against possible sabotage were announced recently in the trade press by Willis J. Spaulding, Commissioner of the Springfield, Ill., plants; and another story from Milwaukee, Wis., indicates that night lighting to prevent sabotage is being installed around the city water plant there. Schenectady, N. Y., has recenly provided protective lighting for its water pumping station, and its reservoir will soon be equipped with lighting designed to prevent possible night sabotage of this important unit.

This important matter of protective lighting for water and sewage plants was discussed by Mr. Swackhamer in an interesting illustrated talk made before the New York section of A.W.W.A. last month in Syracuse, N. Y., in conjunction with a Round Table on "Defense Measures for Water Works."

Because of the timeliness and importance of this topic, permission to print Mr. Swackhamer's paper promptly was requested of and granted by the Association.—L. H. E.

Fig. 1.—The Schenectady Pumping Station.
(Note how properly applied light reveals clearly the presence of a possible saboteur.)

A Few General Rules

Although each case usually needs individual attention before specific recommendations can be made, a few general rules on the use of protective lighting may be given.

1. It is advisable to plan protective lighting for the worst possible visibility conditions so that it will be adequate when sabotage is most likely to be attempted.

2. Protective lighting should be of definite advantage to the property and of disadvantage to the saboteur. If there is any glare in the lighting system, it should be designed to blind the intruder and not the employees or guards.

3. Care should be taken not to create shadowed areas in an attempt to illuminate other areas.

4. Light in the foreground of an area only, reduces distant vision because of contrast. Ample light around the boundary of a property, and at distant points, has distinct advantages.

5. All backgrounds should be kept as light as possible, e.g. by painting fences and buildings in light colors.

6. Area lighting should be planned so that some light is contributed to all important points from more than one source. Thus, one lamp failure will not set up an unduly dark or shadowed area.

7. Lighting along highways, streets, railroads and navigable waterways should be designed so that glare or brightness will not prove a hazard to traffic. The light should be directed across the traffic lanes or at angles which will not be annoying.

8. As much of the lighting equipment as possible should be kept well within the property to frustrate attempts to put it out of operation.

Design Requirements

Regardless of the size and arrangement of the plant or property, the lighting facilities should make it possible for those in charge of the property to detect suspicious characters approaching the fences, attempting to gain entrance, or actually trespassing on the property (Fig. 1); and, as mentioned in Rule 1,

protective lighting should be adequate for poor visibility conditions such as heavy night haze, rain, snow or smoky atmosphere, when the troublemaker would consider conditions favorable for his work.

Experience indicates that an average of from ½ to 1 foot-candle of light should be provided for good night visibility. For example, lighting the boundary fence of a municipal plant with recommended modern pendent street luminaires would require the use of from 2 to 4 watts per linear foot of fence. If floodlighting of the fence or boundary line is desired, from 2½ to 5 watts per linear foot of fence will be adequate with modern medium to narrow beam floodlights, using 1,000 or 1,500-watt general service lamps. In lighting the general plant area with recommended wide-beam floodlights, from .06 to .15 watts per square foot of area involved should be used.

For plants small in area, one of the best methods of lighting is to place at advantageous locations, two or three poles equipped with floodlights (25 to 30 ft. above the ground) which are directed toward the buildings and property lines as illustrated in Fig. 2.

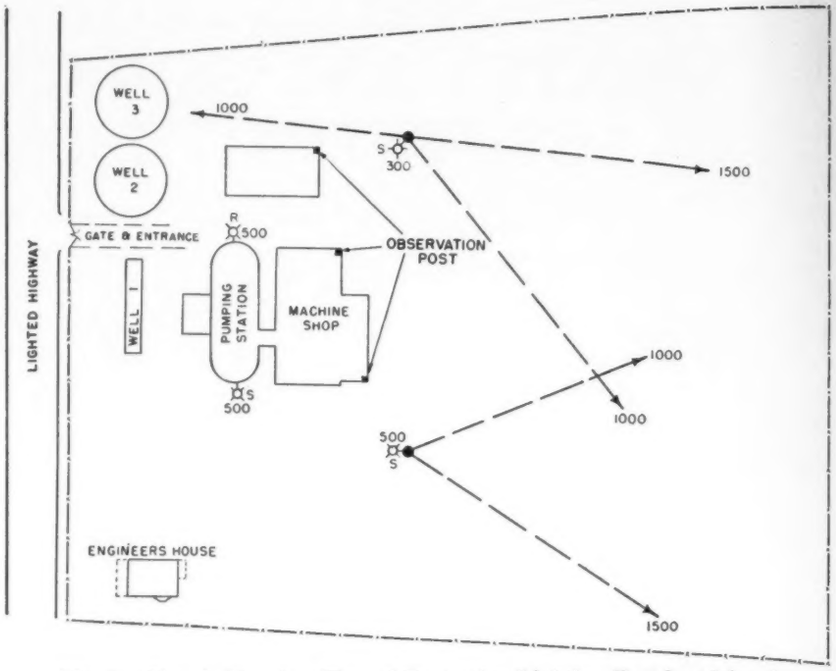


Fig. 2.—Sketch Showing Plan of Protective Lighting Developed for the Schenectady Plant.

(The distribution reservoir is also being protectively lighted.)

In many cases, such as the typical installation referred to, it may be practicable to lay down a blanket of light over the less important areas through which any intruder must necessarily pass in approaching vital points. Under these conditions watchmen are provided with best possible visibility as illustrated in Fig. 3. If the entire area is occupied by vulnerable materials or buildings, the entire boundary line should be illum-

Fig. 3.—A Blanket of Light.

(A very excellent example of effective flood-lighting, but we cannot deny that the snow aided the photographer.)

Fig. 4.—An Example of Fence and Area Lighting.
(This installation at a manufacturing plant was not aided by a snow blanket, as the vegetation reveals. Note the effective shadow elimination secured.)

inated as outlined later in this discussion.

If the municipal plant property is near residences, floodlighting sometimes proves annoying to the nearby home owners. Note in Fig. 2 that floodlights are not directed toward the "engineer's house," but rather that area is illuminated by pendent street luminaires, one installed on the side of the pumping station and another installed on the nearby pole which supports the floodlights used for illuminating the area behind the plant buildings. Note also the pendent street luminaire installed on the opposite side of the pumping station to light the area between the two buildings, and also to provide illumination for the roadway.

Boundary Lighting

In the larger municipal plants, the fence or boundary lines surrounding the property should usually be lighted as a separate unit. In some instances this may satisfactorily meet all requirements, as where the entire property is under continual surveillance by guards.

The fence can be properly illuminated either with pendent street luminaires or medium-beam floodlights. A fence line application of luminaires was made recently by a large eastern manufacturing plant. In this installation the units, using 500-watt lamps, were mounted 25 ft. above the ground. Poles were spaced 125 to 150 ft. apart and set from 10 to 15 ft. inside the fence to prevent tampering from without. The lighting of this fence is shown in Fig. 4.

Constant current series circuits employing 6.6- or 20-ampere series lamps are also extensively used. The choice of electric service usually depends upon the linear distance of fence to be illuminated. Long runs favor the series circuit application. Two series circuit loops, each picking up alternate units, have also been used as an added precaution against failures. Similarly, multiple loop circuits are recommended so that an interruption in the circuit will not cause outages.

When pendent street luminaires are used for fence lighting, an enclosed type unit with a shielded light source and refractor globe is preferred. This makes possible accurate control of the light, and provides an asymmetric distribution of light which will intensify the illumination along the fence line where it is needed most. The shielded light source keeps direct glare of the lamp from the eyes of those on the interior of the enclosure.

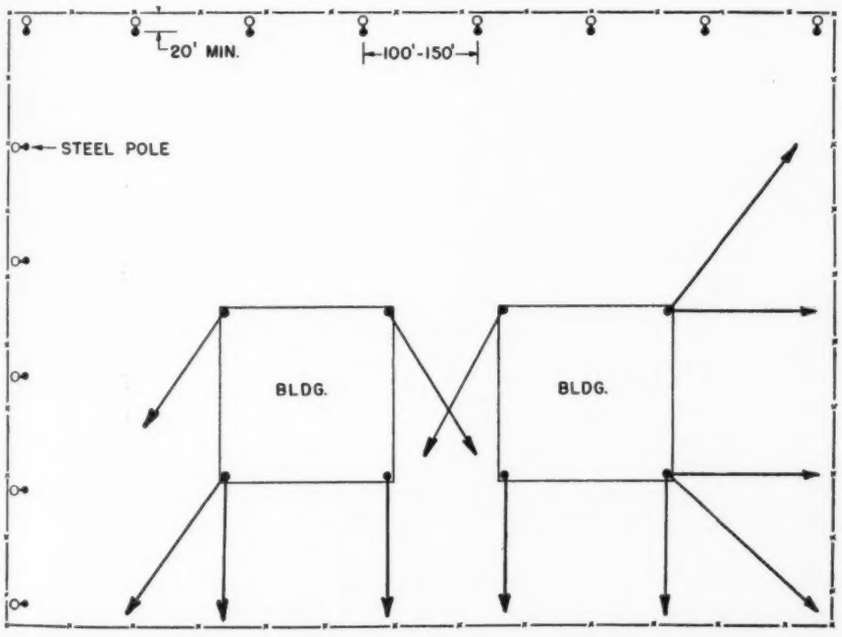


Fig. 5.—Method of Utilizing Floodlights on Nearby Buildings for Both Building and Area Illumination.

Use of Flood Lights

Medium beam floodlights can be used in a fence lighting system. This type of lighting is not as effective as that produced by the pendent lights but is less expensive. The floodlights can be mounted in pairs and aimed in opposite directions along the fence line. They should be mounted at a height of at least

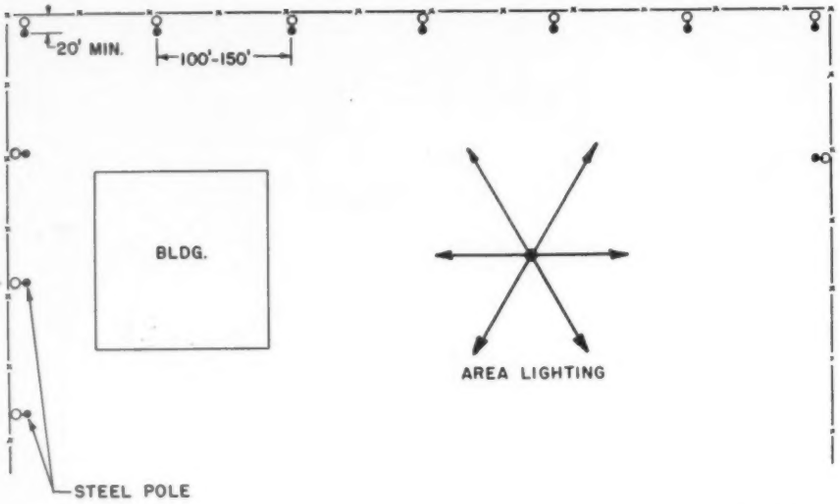


Fig. 6.—Sketch Illustrating One of the Better Known Methods of Area Lighting. "An Illuminating Discussion"

35 or 40 ft. With the long throw of this projected light it is possible to space poles from 300 to 400 ft. apart. If the property line is patrolled in one direction a pole spacing of 300 ft., with single floodlights directed only in the direction from which the guard patrols, will prove a better solution. In either case the guard should keep out of the lighted areas so that he will be concealed from view.

If the buildings to be protected are located so as to permit it, and are high enough (25 to 30 ft.), floodlights or pendent street luminaires may be mounted on the sides of these buildings, or on the roof edges, directing the light into the area. Fig. 5 illustrates this type of installation, and two of the floodlights are directed between these adjacent buildings in such a manner as to eliminate objectionable shadows. Wide-beam floodlights should be used in this instance so that their beams will overlap and provide a more uniform distribution of light.

Fig. 7—"An Illuminating Discussion"

(This is our caption; "G.E." labeled it "More Light on Water Works." In any event John Burwell, Chief Engr. and Supt. of Water at Schenectady, and author Swackhamer were planning for more light on Schenectady's plant when the camera-man came on the scene.)

Advantages of Area Lighting

In cases where buildings are not high enough or are erected far apart, or where there is undeveloped plant area adjoining, a system of area lighting should be employed. Steel or wood poles placed in the area, and supporting sufficient floodlights to illuminate the grounds and buildings completely, (Fig. 6) will prove effective. Floodlights in such a system should be mounted from 50 to 70 ft. high. As the size of the area increases, the number of floodlights, and their mounting height should also be increased. Wide-beam floodlights can be used in smaller areas where it is not necessary to project the light for great distances. For the larger areas, medium beam floodlights with comparatively high candlepower are recommended. Area lighting around plants serves added purposes in speeding up night handling of materials and affording safety to the workers when night-work is required.

An additional method of protective lighting, involving the use of searchlights, can also be used effectively in the protection of larger municipal plants. Their use should be looked upon as a supplement to fence and area lighting and should not be depended upon to furnish a complete protective lighting system. Mounted at strategic elevated locations, the mobility and candlepower of these searchlights will make them a valuable safeguard. They can be used to "sweep" the plant area with light at regular intervals or when the occasion demands. They can also "explore" the grounds outside the plant at night at the slightest suspicion of trouble. Eighteen-inch incandescent searchlights with pilot-house control and 1,000 and 1,500-watt lamps are being used for this supplementary lighting.

CHICAGO FILTER PLANT TO COST $24,000,000; TO BE WORLD'S LARGEST

Progress to date on Chicago's new filter plant shows that the foundations are 95% completed at a cost of approximately $12,000,000, including the breakwater structures, etc.

Bids are being taken on $250,000 worth of steel for the skeleton of the superstructures, involving 2,700 tons of members which may be hard to get under defense program regulation of steel usages.

The completed plant of 320 M.G.D. capacity will constitute the World's Largest Filter Plant, and will have cost a cool $24,000,000.

N. Y. SECTION HOLDS BANNER MEETING

Told of Important Revision of Fire Underwriters Standards

WITH a paid registration of 231 the New York Section of A.W.W.A. in Syracuse on March 27th and 28th held one of the best meetings in its history. Notable was the quality of the technical program which held an unusually large audience in the meeting room during all sessions.

Retiring Chairman*
Charles Cox, Eng'r. N. Y. Dept. of Health Albany

Incoming Chairman
Edgar Wilson, Ch. Eng'r. The Pitometer Co. New York

*(*Mr. Cox was nominated and elected to Directorship on the AWWA Board, succeeding Wm. A. McCaffrey whose 3 year term expires with the close of the Toronto Convention June 26th.)*

The scheme of having the opening technical session start in the early afternoon of the first day and the final session close at noon the following day seems a particularly well chosen plan, permitting those within a half day's travel of the meeting place to travel in both directions by day and necessitating spending but a single night away from home, with minimum expense of attending.

The other happy idea was the arrangement for an inspection trip to points of interest on the local water supply system on the forenoon of the first day and again the afternoon of the closing day, in order to meet the convenience of the greatest numbers.

The Inspection Trip

On the inspection trip members and guests were taken to the yards and shops of the Syracuse Water Department, where they spent some time in the Meter Shop learning how Syracuse maintains and tests meters, as described by Elon P. Stewart, Engineer in Charge of Water Supply. What struck the visitors was the great variety of makes and styles of meters maintained in service on the Syracuse system. And, a focal point of interest proved to be the meter testing layout for checking all sizes and shapes of meters. In the pipe yard was exhibited an interesting section of very old 12 inch cast-iron main, recently removed, a picture of which accompanies this report. Thought to have been laid in 1852, this pipe was as free from tubercules as the day installed.

From the yard and shop went the inspection caravan to see one of America's most unique reservoir developments, involving the leveling off of one of Syracuse's highest hilltops and making maximum use of the limited area by erecting thereon a battery of 3-in-line welded steel ground tanks, given a protective jacket of gunite inside and out. This so-called Morningside Reservoir providing a 10:5 million gallon additional high level storage, automatically controlled, was described later in a

Officers
Wallace T. Miller, Supt., Ossining, N. Y. (Trustee and Program Comm. Chairman)
Hugh S. Dewey, Gen'l. Manager, Western N. Y. Water Co., Buffalo (New Vice-Chairman of Section)
Wm. A. McCaffrey, Supt., Oswego, N. Y. (Section Director, AWWA Board)

paper by Mr. Stewart, which is highlighted further on in this report. This novel storage scheme, having the appearance of giant mushrooms from a distance, proved highly interesting. Amongst other things members learned that there is some "Scotch" in Syracuse's Water Engineer, when observing how he had made one automatic altitude valve do double duty in performing the job of two valves by developing an ingenious arrangement, of the nature of a "hydraulic exciter," to insure spontaneity of functioning.

Entertainment

The customary banquet was followed by a floor show which was, however, far less applauded than a special feature not scheduled. Two young ladies came down from Syracuse University to play for us on violin and piano. The violinist, of familiar name, proved to be the patrician Eleanor Newkirk, daughter of A.W.W.A.'s Sam Newkirk, Sup't of Water at Elizabeth, N. J. The pianist was her room-mate Natalie Caston. A look at the snapshot of our talented artists will reveal how easy it was to look, as well as listen.

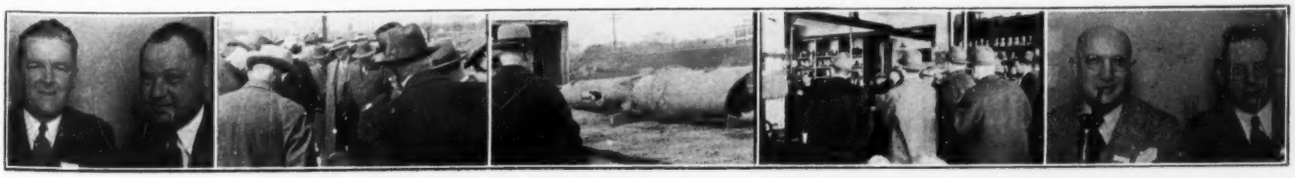
Secy.-Treas.
Rollo K. Blanchard Neptune Meter Co. New York City

Honored
Gordon Yaxley, Supt. Waterford, N. Y. (Fuller Awardist)

Gordon Yaxley Selected for Fuller Award

Waterford's progressive Water Works Superintendent — R. Gordon Yaxley*—was announced by the Fuller Award Committee as the member most deserving of this coveted award for 1941. He was cited for the example set in approaching problems, his initiative and fearless undertakings in seeking a solution, and in reporting results in the literature for the benefit of fellow operators.

*("Bob" to readers of *Water Works and Sewerage's* "Letters from One Super to Another.")



(1) Jas. C. Harding, Cons. Engr., Mt. Kisco, N. Y., and F. R. Matthews, Mt. Kisco's Supt. of Water. (2) Group on Inspection Tour examine interesting section of old C. I. pipe removed from the Syracuse system. (3) The section of 12-inch pipe absolutely free of tuberculation after almost 80 years of service whereas the much newer 4-inch service pipe connected with a saddle and rubber gasket contained tubercules. (4) Supt. Stewart explaining testing procedures in the Syracuse meter shop. If any meter shop can boast a greater variety of make or vintage of meters we haven't seen it. (5) Prof. F. R. Georgia, Cornell Univ., Ithaca, and Wm. W. Watkins, Supt. of Water and Sewerage, Oneonta, N. Y.

Mr. Yaxley in expressing his appreciation and surprise at the picking of a small operator for the award, commented that his selection was an example of the "American Way," in that the non-technical man was given an opportunity to gain recognition as well as those blessed with college degrees. To George Wilcomb, Sup't of Filtration at Albany, as advisory-chemist to Waterford, he felt that a share of the honor belonged. For his Commissioners Mr. Yaxley had much to say in praise, since they never questioned his methods and only asked for the one thing that counts —RESULTS.

Also attending the meeting was J. Walter Ackerman, now a retired country-gentleman. He was introduced and applauded as the distinguished member who is to have honorary membership in A.W.W.A. conferred on him at the Toronto Convention in June.

Wm. H. Clark, Supt., Avon, N. Y. (New Trustee)

John M. Diven, The Leadite Co., New York City (New Membership Committee Chairman, whose Slogan is "Beat California.") Ed. Note—Jack Diven's illustrious father served as president and editor of AWWA, and for 21 years as its secretary.—Look to your "old oaken bucket," California.

Prof. W. L. Malcolm, Director, School of Civil Engineering, Cornell Univ. (Lead Round Table on Defense Measures)

New Officers

The following were nominated and unanimously elected to office for the ensuing year:

Chairman

Edgar K. Wilson, Chief Engr., The Pitometer Co., New York.

Vice-Chairman

Hugh S. Dewey, Gen'l Mgr., Western N. Y. Water Co.

Secretary-Treasurer

Rollo K. Blanchard, Neptune Meter Co., New York.

A. Bradford Squire, Consulting Engineer, Wm. S. Lozier, Inc., Rochester, N. Y.

Robert J. Swackhamer, Illuminating Engr., General Electric Co., Schenectady, N. Y.

Thos. M. Riddick, Consulting Engineer and Chemist, New York City.

Trustees

Wallace T. Miller, Sup't of Water, Ossining, N. Y.

Alan H. Rogers, Sup't Public Works, Garden City, L. I.

Wm. H. Clark, Sup't of Water, Avon, N. Y.

To succeed Wm. A. McCaffrey, whose term as Director of A.W.W.A. expires with the 1941 convention, Chas. R. Cox, retiring Chairman, was chosen to serve the 3-year term as the next Director.

Papers and Discussion

"New Type of Reservoir for Syracuse" by Elon P. Stewart, Engineer and Sup't of Water, Syracuse, N. Y.

Mr. Stewart, in an illustrated presentation, described the novel high level Morningside Reservoir recently completed in Syracuse. This so-called reservoir consists of a battery of ground tanks, arranged three-in-line, to provide 10.5 m.g. added high-level storage available also for low level service through a 30 inch automatic valve. Floating on the line the tanks fill during night and feed out by day. The design was determined by the most appropriate location. Such was secured by taking off the peak of a steep hill and laying on the available 3 acres of hard clay bottom a 3 in. concrete slab floor. On this floor, with but five inch clearance between, was erected 3 welded steel cylinders in line—the two end cylinders being 111 ft. diameter and the center unit 171 ft. across; all being 34 ft. deep. For protection of the steel, a jacket of 2 inches of gunite is applied to interior and exterior of the shells. With equipment rented from the Cement Gun Co. of Allentown, Pa., the gunite, mixed dry (3 sand and 1 cement) and wetted at the gun nozzles, was shot on in vertical strips, the reinforcing consisting of 4 in. mesh wire. Simultaneously with the outside work, the inside work was done from floating rafts raised and lowered by water level adjustment. For increased smoothness a flash finishing coat was later applied. Around the tanks 10,000 shrubs have been planted and the gunite surface will eventually be vine covered.

Flow control is provided through a single 30 inch automatic valve serving as a full tank shut off valve and opening at the first 1/100th lb. pressure drop on the outlet side. A locally designed "hydraulic exciter" produces more spontaneous functioning of this Ross Valve, which had already seen service as a pressure regulating unit elsewhere on the system.

Marshall B. Palmer, Consulting Engr., of Syracuse, who had much to do with design and construction on this project, stated that the cost was $180,000 of which $15,000 was land cost.

Geo. W. Moore, District Engr., N. Y. Dept. of Health, Rochester. (Did yeoman service in Rochester cross-connection misfortune.)

A. C. Hutson, Asst. Chief Engr., Nat'l Board of Fire Underwriters, N. Y. C. (That his Board sees no longer any need for dangerous auxiliary fire-supply cross-connections makes new and important history.)

Elon P. Stewart, Water Engineer, Syracuse, (Had a novel and interesting ground-tank service reservoir project to show the members.)

In reply to questions it was stated that a 16 in. slab of ice in one of the smaller tanks had given no trouble, and there had been no signs of algae growth of consequence, although the tanks are not covered. Interestingly, while there was this 16 in. ice slab on the 111 ft. tank, through which the water flows to the large center unit, the latter had at

(1) R. K. ("Pat.") Patterson and George H. Miner of Johns-Manville Sales Corp., New York and Syracuse. (2) George Carpenter, Supt. of Water and Sewerage, Ithaca, N. Y., and F. R. Shed, Supt. W. N. Y. Water Co.'s East Aurora Plant. (3) Charming and talented were these two co-eds from Syracuse Univ. who played piano and violin during the big dinner. The pianist, Miss Natalie Caston (left), the violinist, Miss Eleanor Newkirk (right), whose proud papa is our own Sam Newkirk, Supt. of Water at Elizabeth, N. J. (4) Fred. Stuart, President, Activated Alum Corp., Baltimore, Md., and C. E. Palmer, Filter Operator, Erie, Pa., and inventor of the successful Palmer Filter Bed Agitator marketed by Stuart's Company. (Good things belong together, so we put this pair next to the young ladies.—Ed.) (5) Wm. I. Collyer, Deputy Comm. of Public Works, White Plains, N. Y., and D. H. Bullock, Supt. Water and Sewerage, Canajoharie, N. Y.—better known as "The Home of Beech-Nut."

(1) J. E. ("Ned") Longley, Lock-Joint Pipe Co., Ampere, N. J. (2) Max Priester, Supt. of Water, Elmira, N. Y. (3) John H. Burwell, Supt. of Water, Schenectady, N. Y. (member of Schenectady's defense committee). (4) Ernest L. Meyer, Supt. of Water, Glens Falls, N. Y. (5) J. D. Thompson, Neptune Meter Co., New York. (6) Beekman C. Little ("Beek"), Secretary Emeritus of A.W.W.A. (lives the life of a gentleman in Rochester). (7) P. S. ("Sid") Wilson, manufacturers' representative, Glen Ridge, N. J. (7) Leo Desmond, Central Foundry Co., N.Y.C. (8) L. H. Wright, Supt. of Water and Sewage, Newark, N. J.

most a 5 in. slab. That the unit having the least water displacement had the least ice constituted something of a puzzle, considering the exposed location of the tanks.

"Pollution of the Rochester Supply Through a Cross Connection and Emergency Disinfection Experiences"—by George W. Moore, District Engr., State Dep't of Health, Rochester, N. Y.

Mr. Moore outlined conditions leading to the pumping in of several million gallons of polluted Genessee River fire-service water into the domestic distribution system of Rochester, before the trouble was located as a cross connection between the city operated high-pressure fire system and the domestic system. Since this matter has already been reported in a digest of a paper presented by Earl Devendorf, of the New York Dep't of Health before the New England Water Works Association (page 122 of our February issue) details will not be covered in this digest.

It is perhaps justified to repeat the experiences with emergency chlorination, because of an important lesson learned through the Rochester experiences. Raising the chlorine dosage to 5 p.p.m. at the regular supply chlorination station, and a vigorous hydrant flushing program, failed to result in residual chlorine reaching the infected area of the distribution system. Even this high chlorine dosage was absorbed by deposits or slime film in the pipe system, which the heavy hydrant flushing program apparently loosened, or at least threw the chlorine into intimate contact with.

Failing to attain the end sought, a large scale "Chlorine Hypodermic" was decided upon. This program involved making of batches of high test hypochlorite solution in the city's street sprinkler carts, and pumping such into infected mains through 100 fire hydrants—the pumping job being done by fire pumpers. Twenty-four hours of 120 injections brought the results desired—positive tests for residual at all points in the infected area, and bacterial tests indicating a sterilized system. Mr. Moore closed by praising the methods and night and Sunday continuous work of Rochester employees in the emergency program.

A. C. Hutson, Ass't Chief Engr., National Board of Fire Underwriters, New York City, explained the results of conferences held in his office looking to elimination of any possible recurrence of the Rochester accident, although it was assumed that all physical cross-connections between the fire system and the domestic system had been eliminated. Rochester is to leave the river supply permanently and provide a steel ground storage tank of 3 m.g. capacity at the fire pumping station, to hold pure water. With the 3,000 g.p.m. obtainable from the domestic system, all fire requirements can be met from the 3 m.g. stored reserve.

L. H. Enslow, Sanitary Engineer, The Chlorine Institute, said that the Rochester experiences and others in which main-station chlorination effects had been too slow in reaching infected main areas, indicated that the method was not dependable for prompt effects. In such instances it was apparent that it was futile to depend upon "hill-top" chlorination and instead go into "gun-boat" chlorination via the "hypodermic method" so successfully employed in Rochester.

"Auxiliary Water Supplies for Fire Protection" by A. C. Hutson, Ass't Chief Engineer, National Board of Fire Underwriters, New York City.

In what was later referred to from the floor as a history making paper, Mr. Hutson stated that no good reason longer existed to warrant requirement of auxiliary fire supplies of a nature possibly hazardous to health. In modern public water supply practices municipalities are in a position to give adequate fire protection from the domestic system and eliminate the auxiliary sources previously required in an earlier day when municipal service was found wanting too frequently and had to be considered inadequately dependable.

In comparing conditions and circumstances of years ago with today, Mr. Hutson pointed out that complete water shut-offs today are a rarity in comparison to earlier days. That cities through Pitometer surveys and systematic hydrant flow tests, better valve maintenance, etc., have improved conditions materially. The greater use of elevated storage had brought marked improvement in fire service, as had the modern automobile fire pumper. He also spoke of the availability of elevated tanks on the property supplied with city water as the most satisfactory sort of auxiliary supply for the important sprinkler system.

(1) S. M. Newkirk, Supt. of Water, Elizabeth, N. J. (2) E. W. Herr, Genl. Mgr., The Gray Chem. Co., Roulette, Pa. (3) J. McClure Wardel, Supt. of Water and Sewage, Hudson, N. Y. (4) Larry Peck, District Mgr., Wallace & Tiernan Co., Albany, N. Y. (5) Wm. H. Roberts, Comm. of Public Works, Rochester, N. Y. (6) Victor E. Arnold, President, Phoenix Meter Co., Prince's Bay, Staten Island, N. Y.

With the vast improvement in dependability and adequacy of municipal supplies, Mr. Hutson said that in the revision of Standards of the National Board of Fire Underwriters, made only in June, 1940, the old Standard requirement of not less than *two* independent supplies has been deleted. Instead, the new Standard calls for but "one supply of adequate pressure, capacity and reliability." Further *"A connection from a reliable water works system, of adequate capacity and pressure, is preferable as the single or primary supply."*

Mr. Hutson concluded with the outright statement that "*A fire service supply of an adequacy and reliability suitable for practically any occupancy, can be provided through a municipal water works system.* The question as to whether an auxiliary supply should also be installed, often involving pollution dangers, is one which in many cases can be answered by the strengthening of the public water supply system in the vicinity of the particular plant; or, by the simple erection of an elevated tank on the property for storage of city water." Also in his opinion, and judging from progress being made, "it is believed that the obligation on the part of the municipality of furnishing adequate fire protection will be so well recognized as to make auxiliary supplies largely unnecessary."

Earl Devendorf, Ass't. Chief Engr., N. Y. State Dep't. of Health, was quick to his feet to say that history was being made in Mr. Hutson's paper. Now it would be the job of water works men to assure reliability and adequacy of supply if the Underwriters are to continue with their present gratifying attitude.

The Round Table

(Practical Problems in Elimination of Cross Connections)

Under the leadership of Hugh S. Dewey General Manager, Western N. Y. Water Co., this timely topic was brought up for discussion, but disappointingly little developed.

Chas. R. Cox prefaced the topic by pointing out that in the survey of water borne outbreaks made by Wolman and Gorman 10 per cent had been traced to cross connection pollution.

L. A. Bergman, Director of Water, Buffalo, requested by the chair to tell of his program, stated that since the Rochester scare, Buffalo has had a crew of 3 men working daily searching out cross connections; 176 inspections had revealed 9 important cross connections in large plants. It was their intention to track them all down.

J. McClure Wardel, Sup't., Hudson, N. Y., reported the only cross-connections permitted in Hudson were those with a section of pipe removed or else water is piped to industrial and railroad tanks over the top, in which no physical connection existed.

George Carpenter, Supt. of Water and Sewerage, Ithaca, N. Y., in commenting on plumbing hazards, stated that the Water and Sewer Department was taking over plumbing inspection in Ithaca, in an effort to control the hazard of back-syphonage as well as cross-connections.

The Second Day

"Speedy Design and Construction of a Camp Water Supply System" by A. Bradford Squire, Wm. S. Lozier, Inc., Consulting Engineers, Rochester, N. Y.

Mr. Squire related experiences (some epic) in providing a modern water supply system for Pine Camp under winter conditions of Northern N. Y. State and the necessity of speedy completion, with contractors due on the job only two weeks after the appointment of engineers in November. Pine Camp, with 764 buildings and $30,000,000 in equipment, is to house an Armored Division, which on the march with 3,500 units of equipment will stretch over 100 miles of road.

After hurried surveys for supply sources it was decided to develop a ground water supply and, after putting down 13 test wells 48 to 172 ft. in the deep sandy formation, contract was let to the Layne-New York Company on a guarantee basis of yield for gravel-pack type of wells. Seven wells put down yield 1250 g.p.m. without affecting adjacent wells. For storage, two elevated tanks of 500,000 gal. each are located on opposite sides of the camp. Interesting was the fact that two half million gallon tanks, representing storage of 50 per cent of estimated demand of 2 m.g.d., proved of less cost than a single unit of twice the capacity, the low bid coming from Pittsburgh-Des Moines Steel Co. At each 1 ft. drop in water elevation another well pump automatically goes into operation in changeable sequence. To avoid tank freezing in a climate of 20 to 35 deg. below, water passes through these tanks continuously.

Some conception of the size of the project was had from the 253 fire hydrants, 500 valves and 72,000 ft. of service pipe involved. A loop of 12 in. C.I. feeder main, gridded with 8 in. laterals, comprises the distribution system, this being valved to avoid more than 1500 ft. of main out of service at one time. Construction difficulties involved trenching of 6 ft. minimum cover in deep frozen ground, necessitating the building of fires over the trench location ahead of operations, and the use of a "rooter" plow requiring 400 h.p. to operate, and breaking out frozen sand the equal of sandstone. During well construction drilling crews were actually isolated by heavy snows for days at a time. With it all the system was ready for troops on March 15th, with ample water of only 2 grain hardness.

Mr. Squire said that he could not close without an expression of appreciation to U. S. Pipe and Foundry Co., Hydraulic Equipment Co., Wallace and Tiernan Co., the Rensselaer, the Kennedy and the Darling valve companies, and Pittsburgh-Des Moines Steel Co., for the utmost cooperation and aid in getting the project through under the stress and strain of pressure and the tough going of winter.

Major Tyler, Camp Construction Q.M., was present, and gave high praise to Mr. Squire's handling of the project and to all who contributed to the speed of completion.

"Current Difficulties in Water Treatment" by Thomas R. Riddick, Consulting Engineer and Chemist, New York, N. Y.

Mr. Riddick's paper proved to contain much food for thought, and indicated the care with which the author has studied the topics chosen for discussion—namely, the two important "C" problems in water treatment, "Coagulation and Corrosion."

Pointing out that, because of the lack of any measuring device to reveal effective coagulation and flocculation, other than the human eye, that practice still remained to large degree an art and settleability and filtrability remain the best evidences of proper flocculation. Cold weather brings the greatest coagulation difficulties, with weak or tender floc. After much speculation by many as to the cause, Mr. Riddick said that Baylis seems to have hit on the cause in claiming a lack of silica as being responsible. It was Baylis who had advocated the addition of an acid neutralized soluble silicate during such periods, usually at times of lowest raw water turbidity. The needed dosage in Mr. Riddick's experience provides 4 to 8 p.p.m. of $Si\ O_2$—the criterion being a total silica content (naturally present plus that added) of not less than 8 to 10 p.p.m. He cited actual cases under his supervision wherein large and flaky but tender floc resulted in low alkalinity waters when silica content dropped to 4 or 5 p.p.m. Changing coagulant from alum to iron salts resulted in little improvement. The application of neutralized silicate of soda by the Baylis scheme (first reported in WATER WORKS AND SEWERAGE) to raise the silica content to 8 to 10 p.p.m. brought prompt re-

lief in producing a tough rapidity settling floc. Mr. Riddick warned. however, that silica treatment is not what might be termed fool-proof. For instance, silicate application is not impressive unless made in the mixing chamber *after* the floc nuclei have begun to form, or unless there is at least turbidity of 5 parts in the raw water. Another important consideration is in the neutralization of the alkaline silicate with sulphuric acid. To avoid reaching the silica-jell point toward the end of the neutralization precaution must be taken not to run down below the safe point of 1200 p.p.m. alkalinity.

Another coagulation aid in low temperature—low turbidity periods had proved to be return of freshly precipitated sludge, in amount of ½ to 1 per cent, to the raw water. The use of activated carbon has been a decided asset in keeping the returned sludge "sweet," and failures with the scheme previously has been attributed to sludge degradation or spoilage. In consequence only the freshest sludge can be so used and carbon seems to aid materially in sludge stabilization.

Taking up the topic of corrosion, its consideration and attempts at control, Mr. Riddick questioned exactly where we stand in adjusting theoretical considerations, predictions (and much hopeful thinking) to actual observations. He felt convinced that too little attention had been given practical observations, and too much to theory and what may be considered "gospel-text" in published and re-published material. Having observed relative corrosivity of about 50 waters and a study of their mineral make up, alkalinity, pH values, oxygen and CO_2 content, led him to question dependence on pH adjustment of filtered waters as a cure of corrosion phenomena. Red water had been stopped but not tuberculation. A study of these 50 waters brought to light but one relationship between chemical make-up and corrosivity, when taking cognizance of practical observations of conditions on each system. The important variation was not pH or CO_2 or oxygen content, but the ratio of titratable alkalinity to total hardness; or, more exactly, the ratio of bicarbonate to non-carbonate hardness. In these waters the latter consists essentially of the sulphates of calcium and magnesium naturally present, plus that resulting from coagulation which converts alkaline bicarbonates to sulphates. Almost without exception the lower the sulphate and chloride content in respect to total alkalinity, the less the corrosivity.

The apparent advantage of the highest permissible ratio of carbonate hardness (alkalinity) to non-carbonate hardness had led him to substitute soda ash for lime in adjustment of the calcium carbonate saturation equilibrium through increased pH value; and, more importantly, the total titratable alkalinity as carbonate and bicarbonate to counter the sulphate increase due to coagulation—to wit:

$$Ca\ CO_3 + Alum = Ca\ SO_4 + CO_2$$
$$Ca\ SO_4 + Na_2CO_3 = Ca\ CO_3 + Na_2\ SO_4$$

On the other hand, when employing lime for the pH adjustment only the hydroxyl ion is contributed.

Another consideration of importance seemed to be the silica content —corrosion being more pronounced with silica deficiency and, in consequence, more pronounced with polished filtered water as practical observations reveal. In this connection we are reminded that silicate treatment is an effective suppressor of corrosion, and protective scales examined yield silica invariably, said Mr. Riddick. In more than one regard then silica deserved attention in coagulation and corrosion suppression.

In the matter of establishing the desired carbonate to non-carbonate in ratio of 1: 1.33 or better in corrosion suppression, Mr. Riddick cited a severe case involving a water of 9 alkalinity; hardness 40; pH 5.5 and 40 parts CO_2. To use soda ash alone to establish 1: 1.33 ratio produced a soda taste. Therefore to absorb the CO_2 caustic soda was employed and a mixture of 50 per cent caustic and 50 per cent soda ash proved the successful compromise, with satisfying results from all angles—including relief from attack of brass piping. Except for the desire to avoid boosting the 60 parts hardness any higher lime might have successfully supplanted the more expensive caustic soda.

L. H. Enslow, in complimenting Mr. Riddick on his informative and invigorating paper, felt convinced that the author had brought forward some very pertinent and worthy considerations. One thing was certain, and that is pH adjustment of filtered waters with lime alone had not stopped attack on ferrous pipes. There were two aspects to consider. Red water correction seemed entirely successful with lime but tuberculation of mains continued. A study of the cause and effect would reveal that cast iron pipes never pit through because the alkalinity of the water is sufficient to scab-over the pit sore with precipitated iron—the tubercule. Deficient alkalinity means that the sore continues to bleed and so-called red-water results. When the healing alkalinity is raised with lime the sore stops bleeding but the tubercule scab grows.

By one close student of corrosion and tuberculation it has been advocated that to avoid tuberculation there is no half-way stopping point between a pH of 5 or less and one of 9.5 or higher, which lays down a calcium carbonate deposition. So, where do we stand on pH adjustment as the sole measure of correcting corrosivity? Mr. Riddick has suggested an interesting and worth considering means of adjusting the carbonate and non-carbonate balance, which returns a higher $Ca\ CO_3$ content per unit of pH increase than is obtained from lime application. His comments on silica are pertinent.

What about pipe linings on which we are still quite dependent for prevention of tuberculation, while suppressing red-water occurrences? The secret of the effectiveness or failure of linings seems to lie only in two details (1) their insolubility, (2) their porosity. If the coal tar coating is applied properly the thickness is of secondary importance to porosity. The porous lining allows the taking into solution of the iron and when the metal in solution works out to the water face of the lining the natural alkalinity (plus oxygen) of the water precipitates some of the iron in situ and a pimple of hydrous iron oxide is established. These pimples grow into tubercules. If we have insufficient alkalinity to fix the iron in place we have iron stained water; if we have abundant alkalinity we correct the first but tubercules grow. So we continue to be dependent on a satisfactory lining for our pipes, ever hopeful that a universally effective and satisfactory means of correcting water corrosivity will appear.

"Protective Lighting of Water Works Properties" by R. J. Swackhamer, Illuminating Engineering Laboratory, General Electric Co., Schenectady, N. Y.

Mr. Swackhamer, talking from lantern slides, discussed general principles in protective lighting of plants and properties and presented examples of various lighting layouts and type units most useful for water works plants. His paper being of timely importance is to be found printed in full elsewhere in this issue.

Round Table

National Defense in Public Water Supplies

Leader—Prof. W. L. Malcolm, Cornell Universiy.

Professor Malcolm in introducing this topic presented a skeleton of suggestions and recommendations for water works managers and operating personnel to consider in safeguarding water supply works against possible sabotage, which had been gathered from various sources and based on British experiences. The suggestions included the following:

(1) The careful scrutiny and interrogation of all plant visitors, detaining them for further questioning if not satisfied with their explanation.
(2) Careful investigation of all employes and their associates.
(3) Study of the system for the points of greatest weakness and strengthen such.
(4) Have an accurate knowledge and record of valving and know what valve closures will isolate any given section of the system.
(5) Eliminate dead ends and plan how to pump into isolated areas with fire pumpers.
(6) Plan distribution of materials and equipment needed in emergency repairs.
(7) Plan closest cooperation with fire fighting units.
(8) Above all, submerge self and eliminate personalities in all planning to so important an end.

Gordon Yaxley—Sup't at Waterford, N. Y. called attention to the importance of valve protection and the possibilities of a saboteur without much difficulty putting a valve out of service which will put the main on both sides of such valve out of commission at one stroke.

Thos. R. Riddick, Cons. Engr., New York, pointed to the dangers of system infection by pumping in bacterial culture through a house connection. Such an infection would not be discovered until the damage had been done. In this direction he felt that it was the more important to maintain high residuals of chlorine (0.4 to .5 p.p.m.) throughout the system by employing ammonia-chlorine to attain this end.

Chas. R. Cox, asked for an expression on this aspect of protection, agreed that the maintenance of residual chlorine in the distribution system was of importance, and New York City is at present installing five additional chlorinating stations for this very purpose.

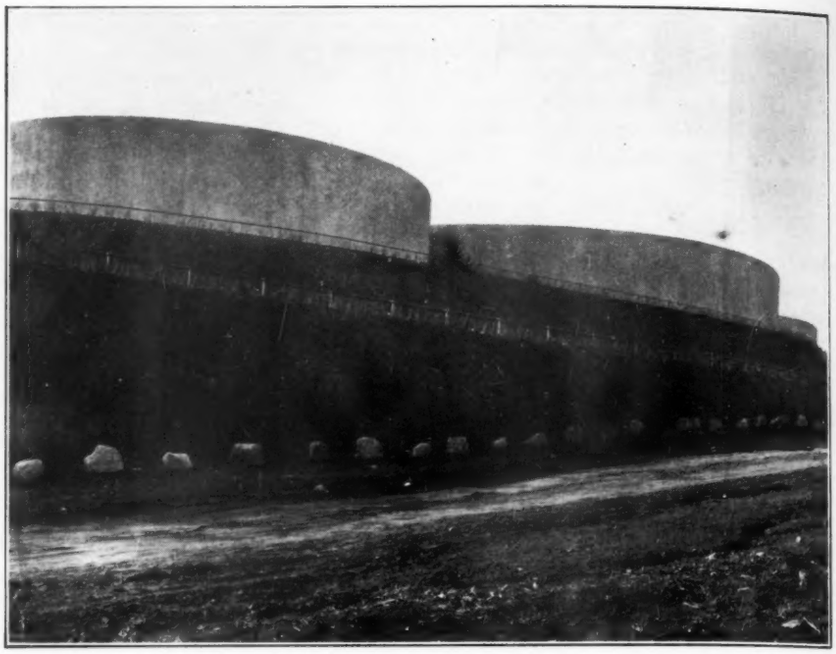
Edgar K. Wilson, Chief Engr., The Pitometer Company, warned that the condition of valves would prove of greatest importance.

"Wm. Highberger, Mathieson Alkali Works, New York, hoped that there would be no panicky ordering of chlorine in advance of needs, because it would swamp the chlorine producers and the cylinders thus taken out of circulation by those holding chlorine in reserve would seriously tie-up the available cylinder supply and cause considerable difficulty in distributing chlorine equitably.

H. E. Jordan, Secretary, A.W.W.A., was of the opinion that in the National Planning there would result a National Coordinator of Defense. A Manual of Civilian Defense is now practically ready and a Manual of Air Attack Defense is being produced. Concerning British experiences, he had heard of no major disruption of water supply, and even in France no utilities had been disturbed. Fortunately, pipe lines and mains did not make satisfactory targets from the air, being hidden under a protective earth cover. In the bombing of Bristol, on the third night there was a chance hit disrupting a shallow trunk main.

L. H. Enslow said that he would like to add one thought by repeating a most worthy recommendation made by Norman J. Howard, President of A.W.W.A., who suggests a careful safeguard of all plans and drawings of importance covering the local system. In this direction two or more complete sets of prints should be made available for keeping at more than one location, to preclude the possible calamity of disappearance of important drawings at a critical time. That the original tracings should be stored in the safest possible place went without saying.

Another thought for consideration was that of a cooperative type of planning by water works managers in neighboring communities. In short, this "brotherhood" idea would involve an exchange of information as to what equipment and materials each of the neighboring departments had on hand of a nature which might be needed in an unexpected emergency, and an understanding that all neighbors would come to the aid of the one in trouble when trouble strikes. In this manner a given area might have a very adequate line of emergency equipment available within quick trucking distance of the plants therein, without the necessity of each attempting to stock all lines of emergency equipment. Mr. Enslow observed this "one for all, and all for one" spirit amongst water works superintendents of Kennebec Valley in Maine and how effective it was in helping the "Musketeer" in trouble.



"Marvin's Mushrooms"*

(Otherwise the unique and interesting hill-top tank battery of Syracuse, N. Y., officially designated the Morningside Reservoir. Adding 10.5 M.G. of high-level storage on a topped hill this battery consists of three 34-ft. deep welded steel cylinders bonded to concrete slab floors and protected by a jacket of gunite.)

**So dubbed locally in a linkage of the mayor's name with this development, resembling giant mushrooms at a distance, which seemed to grow almost overnight.*

PERTINENT PACKING POINTERS*

The following suggestions and warnings, based on the many years of practical experience of a prominent eastern packing manufacturer, will be found valuable in the installation of packings. To follow them may mean freedom from trouble that would occur when even the best packing is improperly installed.

1. NEVER fail to make clear to the manufacturer what the packing is to pack. In other words, with what will the packing make contact?
2. NEVER guess at a size, diameter, width, or height, when ordering packing. Many failures result from small errors in dimensions.
3. NEVER allow too little or too much clearance between follower plate and inside cup wall, or any metal parts behind any upright leather wall. Clearances of 1/16" to 3/32" on each side, depending on size of packing, is recommended.
4. NEVER doctor packing lips with a pocket knife or file, or batter lip in installing. A rounded lip destroys the seal. Packings can be softened by soaking in warm water if necessary.
5. NEVER apply cup packings with flange too high for clearance at the head of the cylinder. Keep systems clean, so sediment will not collect in cylinders and wear the packing.
6. NEVER apply cup packings to end of badly worn plungers; pressure will force the packing down into clearance between plunger and cylinder. Leather washers cut from old cup packings can be made to reline such equipment to proper dimensions.
7. NEVER apply "U" packings where plungers are worn without reinforcing under the heel with leather cushion rings.
8. NEVER look for long service on scored plungers or in scored cylinders; resurface or reline such equipment to proper dimensions.
9. NEVER allow water to corrode cylinder walls, plungers, stems or rods. Use an anti-rust agent that will prevent this and will act as a lubricant.
10. NEVER squeeze hemp or fabric filled "U" packings in glands where such packings are to replace solid section compression packings; set gland up to point where "U" packings are free to function properly.

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

LOS ANGELES TAKES NOTE OF 300,000TH METER INSTALLED

(Photo, Courtesy Neptune Meter Co.)
Geo. C. Sopp, Supt. of Meters and Services Turns Water Through Los Angeles' Meter No. 300,000 While Former Supt. George Read (retired) Looks on for Benefit of Press Cameramen.

On a thoroughfare overlooking the beautiful campus of the University of California at Los Angeles, a group of city officials met recently in a unique ceremony.

Under the supervision of Geo. C. Sopp, Supt. of Meters and Services, and with representatives of the press in attendance, a water meter was installed! Not just another meter, but distinguished as the 300,000th in the Los Angeles system.

The witnesses included Thad M. Erwin, Water Sales Agent of the Los Angeles Bureau of Water, L. E. Goit, Engineer in Charge of Distribution, and as honored guest, veteran George Read, who lately relinquished the superintendency of Meters and Services after forty years' service in that capacity.

These proceedings were chronicled with considerable fanfare in the Los Angeles newspapers; but, oddly enough, the press quite missed the underlying significance of the event.

Seizing upon Chief Engineer H. A. Van Norman's statement that there was now one water meter for every five inhabitants, the press in a pardonable burst of civic pride emphasized this new "yardstick" for gauging the phenomenal growth of Los Angeles.

Bureau statistics were cited to show the step-by-step development in the number of meters employed by the Los Angeles water system: 319 in the year 1902; 5,347 in 1905; 35,955 in 1910; then 692,628, 110,783, 200,935, 243,097 and 253,976 meters in five-year intervals up to 1935 . . . with the increase accelerated, in 1940, to an average of nearly 1,000 meters monthly.

But the real story behind these impressive figures was contributed by Mr. Sopp, sponsor of the celebration.

"Bear in mind that when the city purchased the old Los Angeles Water Co. in 1902 and commenced operating its own municipal water system, only 319 meters were in service throughout the entire city," he remarked. "At that time—note this fact carefully — Los Angeles was using a total of 26,000,000 gallons daily, or approximately 306 gallons per capita . . . more gallons of water utilized per capita than by any other city in the United States, and representing a very considerable waste."

The Water Bureau management realized that it faced a serious problem, Mr. Sopp explained. A curtailing of this tremendous waste of water was vital to the wellbeing of a city located in a semi-arid region where water was none too plentiful and had to be obtained from the high mountain regions several hundreds of miles distant from the city limits.

Purely as an experiment, the management purchased a few hundred additional meters in 1902 and installed them on the system. Results were more than gratifying—they were considered amazing. Despite the constantly increasing population, the daily water consumption was reduced at that time to a mere 3,000,000 gallons!

Mr. Sopp took occasion to point out that for the fiscal year ending June 30, 1940, the Los Angeles water system was called upon to supply a demand of more than seventy times the requirements of 1902, yet the average daily per capita consumption was held to only 122 gallons. Such efficient control of water consumption, he maintained, was due almost entirely to the "100% metering" of all domestic and irrigation services.

TORONTO CONVENTION STRAWS

Many ask is the A.W.W.A. Convention in Canada to be a success under the war conditions?

The straws in the wind appear to be the best answer to this question —not forgetting that the last Toronto Convention was the largest and most successful of any A.W.W.A. convention for many years.

First Straw—From President N. J. Howard in Toronto comes advice that hotel reservations at this date have already exceeded those made in advance for the Kansas City Convention.

Second Straw—Everything is being done to see that there is to be no difficulty in those from the U. S. getting into Canada.

Third Straw—Rate of exchange of the U. S. dollar into Canadian dollars will make expenses in Canada look easy, and merchandise cheap.

Fourth Straw—A good representation of exhibitors who have made reservations for booth space. Those manufacturers who at this writing have signed up to April 1st follow:

Exhibitors

Activated Alum Corp.
American Cast Iron Pipe Co.
American City Magazine
American Rolling Mill Co.
Atlas Mineral Products Co.
Badger Meter Mfg. Co.
Barrett Company
Bingham & Taylor Corp.
Buffalo Meter Co.
Builders Iron Foundry
Calgon, Inc.
Carson Cadillac Corp.
Central Foundry Co.
Centriline Corp.
Chapman Valve Mfg. Co.
Chicago Bridge & Iron Co.
Clayton Mfg. Co.
Cliffs Dow Chemical Co.
Crane Company
Darco Corp.
DeLaval Steam Turbine Co.
Dorr Company, Inc.
Dresser Mfg. Company
Engineering News-Record
Ford Meter Box Co.
General Paint Corp.
Michael Hayman & Co.
Hays Mfg. Company
Hersey Mfg. Company
Homelite Corporation
Hydraulic Development Corp.
Industrial Chemical Sales
International Filter Co.
Johns-Manville
Layne-Bowler Company
Lead Industries Assn.
Lock Joint Pipe Company
Ludlow Valve Mfg. Co.
McWane Cast Iron Pipe Co.
Monsanto Chemical Co.
Mueller Company
National Iron Corp., Ltd.
National Meter Company
National Tube Company
National Water Main Cleaning Co.
Neptune Meter Company
Permutit Company
Pitometer Company
Pittsburgh-DesMoines Steel Co.
Pittsburgh Equitable Meter Co.
%Proportioneers, Inc.%
Public Works Journal Corp.
Rensselaer Valve Co.
Salomon, L. A. & Bro.
Simplex Valve & Meter Co.
Smith, A. P. Mfg. Co.
Sparling, R. W.
Thomson Meter Corp.
U. S. Pipe & Foundry Co.
Victaulic Co. of Canada, Ltd.
Vogt Mfg. Co.
Wailes Dove-Hermiston Corp.
Wallace & Tiernan Co., Inc.
Waterous Company
Water Works Engineering
Water Works & Sewerage
Wood, R. D., Co.
Worthington-Gamon Meter Co.

GEORGE HAZLEHURST PASSES

Long Chief Engineer of the Alabama Dept. of Health

George Hall Hazlehurst, Chief Engineer of the Alabama State Dept. of Health, died on March 7, 1941, at his home in Montgomery.

Mr. Hazlehurst was born September 27, 1887, at Macon, Georgia. From Rensselaer Polytechnic Institute he was graduated in 1910 with the degree of Civil Engineer. He later attended the Graduate School of Science at Harvard University where in 1913 he was awarded the Master of Civil Engineering degree.

Mr. Hazlehurst was one of the outstanding sanitary engineers in the South and was recognized as a leader in the field of sanitation. He became affiliated with the State of Alabama November 1, 1917. Prior to this he had been resident engineer on several large water plants, water distribution systems, and sewer systems. He had been on the staff of the American Water Softener Company in Philadelphia, sanitary engineer for the Atlantic Coast Line Railway, and associated with his father, J. N. Hazlehurst, in Atlanta, Georgia. During the early part of the first World War he served as sanitary engineer with the Rockefeller Foundation in Serbia.

He was a member of the American Water Works Association, New England Water Works Association, American Public Health Association, National Malaria Committee, Conference of State Sanitary Engineers, and the Board of Malaria Consultants of the Tennessee Valley Authority.

CROSBY-FISKE-FORSTER HANDBOOK OF FIRE PROTECTION (NINTH EDITION)

GENERAL EDITOR—ROBERT S. MOULTON
Publishers—National Fire Protection Association, 60 Batterymarch St., Boston, Mass.
$4.50 Postpaid.

Of interest to engineers is the new 1300 page Ninth Edition of the Crosby-Fiske-Forster Handbook of Fire Protection, published by the National Fire Protection Association. Sections of the 9th edition which are completely new include the following: Detailed information concerning the hazards and fire protection of air conditioning systems; an entire chapter relating to mine fires and explosions; quantities of material about special extinguishing systems; and many other items. In addition, each chapter of the Handbook has undergone numerous revisions and changes since the 8th edition of five years ago. Notable among the changes are: The table of properties of flammable gases and solids which has been throughly revised; the chapter dealing with electricity now contains a considerable amount of new information including fire hazards of static charges; the several chapters relating to automatic sprinkler protection; and changes and additions appear in all sections of the book which deal with either public or private fire protection. All statistics including tables, charts, and diagrams have been brought up-to-date in the new edition.

The net result of changes, and new material, is a thoroughly up-to-date and complete Handbook of Fire Protection, constituting a quality publication of 1300 pages, and representing the work of the more than 100 leading authorities who have put their knowledge and experience at the disposal of the National Fire Protection Association. Copies may be ordered directly from N.F.P.A. Headquarters at 60 Batterymarch St., Boston, Mass. at the nominal charge of $4.50 per copy.

SPEAKING IN CONFIDENCE

Getting out this paper is no picnic.
If we print jokes, people say we are silly;
If we don't, they say we are too serious;
If we clip things from other papers, we are too lazy to write them ourselves;
If we stick close to the job all the time,
We ought to be out hunting up news;
If we go out and try to hustle,
We ought to be in the office;
If we don't print contributions,
We don't appreciate true genius;
And if we do print them, the paper is filled with junk;
If we make a change in the other fellow's write-up, we are too critical;
If we don't, we are asleep.
Now like as not some guy will say
We swiped this from some magazine!
WE DID!

(What's more, we can't recall which magazine, either.—Ed.)

HOW "FLUSH-KLEEN" SYSTEM PREVENTS PUMP CLOGGING

Rags and Other Coarse Sewage Matter Do Not Pass Through Impellers.

Pumps Handle Strained Sewage Only.

While one pump is operating, sewage flows into basin through idle pump.

FILLING WET WELL

(1) Sewage flows through inlet pipe.

(2) Coarse sewage matter is retained by strainer.

(3) Strained sewage flows through idle pump to basin.

PUMPING

(3) Strained sewage is pumped from basin.

(2) Coarse sewage matter is backwashed from strainer.

(4) Special check valve closes; sewage and coarse matter are pumped to sewer.

Both pumps operate under peak flows.

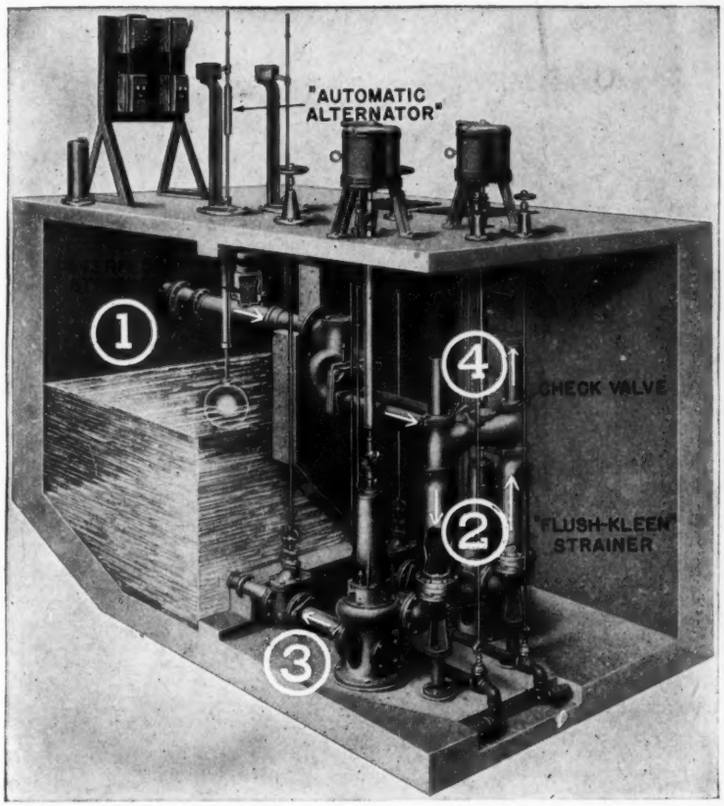


Fig. 2037—"Flush-Kleen" Sewage Pumping Station. While one pump is operating, sewage flows into the basin through the idle pump, as indicated by arrows. Coarse sewage matter is retained by the "Flush-Kleen" strainer in the idle pump (2). Only strained sewage passes through impeller to wet basin. When the idle pump operates, the coarse sewage matter in the strainer chamber is flushed out through the discharge pipe with the strained sewage from the wet basin. The check valve prevents operating pump from discharging back through the inlet line. In the meantime, sewage flows into the wet basin through the idle pump. Automatic Alternator transfers operation from one pump to the other. Both pumps may operate during peak flow, at which time sewage inflow is through overflow strainer.

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REPRESENTATIVES THROUGHOUT THE UNITED STATES AND FOREIGN COUNTRIES

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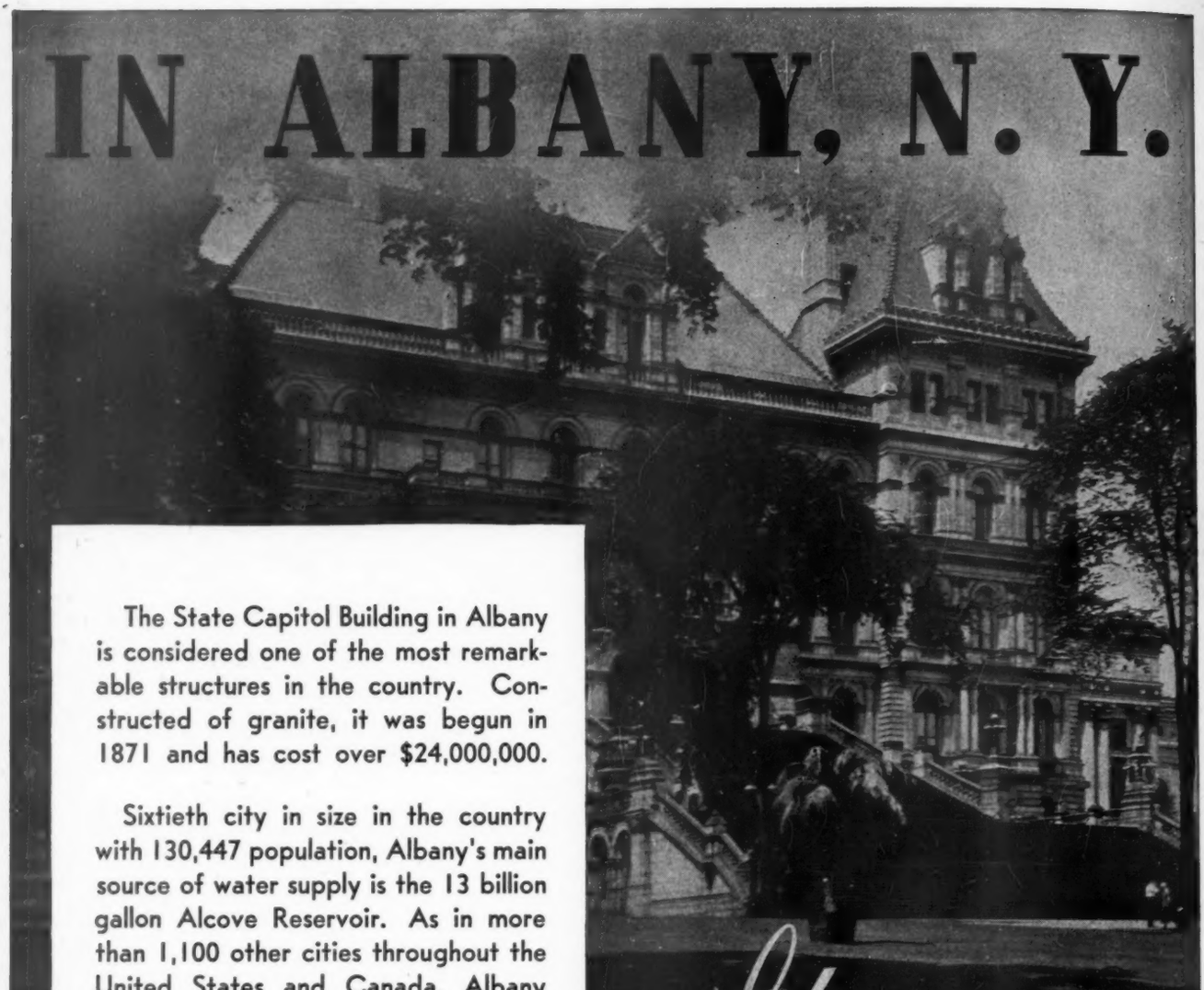

The State Capitol Building in Albany is considered one of the most remarkable structures in the country. Constructed of granite, it was begun in 1871 and has cost over $24,000,000.

Sixtieth city in size in the country with 130,447 population, Albany's main source of water supply is the 13 billion gallon Alcove Reservoir. As in more than 1,100 other cities throughout the United States and Canada, Albany uses AQUA NUCHAR Active Carbon to remove tastes and odors which develop due to algae growth.

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Shown above is America's oldest cast iron water main now in its 120th year of service in Philadelphia. The *proved* useful life of cast iron pipe is at least double the *estimated* life of any other pipe used for underground mains.

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PUBLIC TAX SAVER NO. 1

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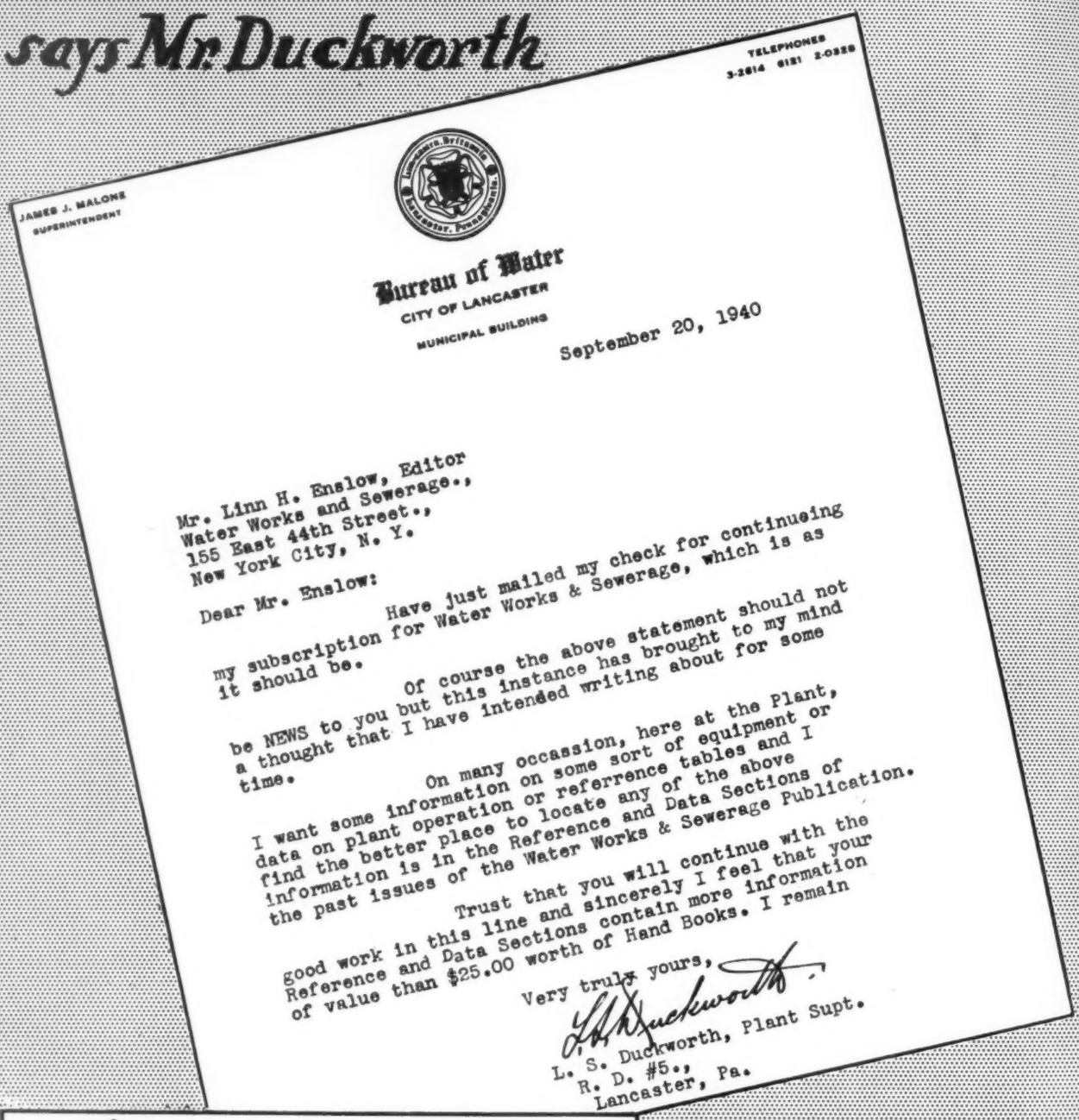

JAMES J. MALONE
SUPERINTENDENT

TELEPHONES
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Bureau of Water
CITY OF LANCASTER
MUNICIPAL BUILDING

September 20, 1940

Mr. Linn H. Enslow, Editor
Water Works and Sewerage.,
155 East 44th Street.,
New York City, N. Y.

Dear Mr. Enslow:

Have just mailed my check for continuing my subscription for Water Works & Sewerage, which is as it should be.

Of course the above statement should not be NEWS to you but this instance has brought to my mind a thought that I have intended writing about for some time.

On many occassion, here at the Plant, I want some information on some sort of equipment or data on plant operation or referrence tables and I find the better place to locate any of the above information is in the Reference and Data Sections of the past issues of the Water Works & Sewerage Publication.

Trust that you will continue with the good work in this line and sincerely I feel that your Reference and Data Sections contain more information of value than $25.00 worth of Hand Books. I remain

Very truly yours,

L. S. Duckworth

L. S. Duckworth, Plant Supt.
R. D. #5.,
Lancaster, Pa.

Every manufacturer of Water Works and Sewerage equipment and materials should plan now to use adequate space in the June 1941 Convention Reference & Data Issue. An effective but inexpensive way to tell your sales story story in Catalog form — Ask us for details now!

WATER WORKS
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ARIZONA ASSOCIATION HOST TO CALIFORNIA WATER AND SEWAGE ASSOCIATIONS

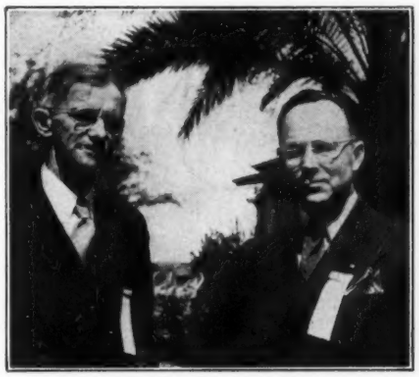
At Meeting Held in the Border City of Yuma, Ariz.

A Report by A. M. RAWN*
Associate Editor

BORDER city Yuma is located where California and Arizona come up to meet at the Colorado River down just north of the Mexican line. The city was established about the middle of the last century as an army post for protection against marauding Mexicans and to hold Arizona Indians on their reservations. The post was established on the California side of the river, and due, no doubt, to its protective influence, there developed a modest land boom in the area in which lots became so expensive that settlers moved to the other side to establish a new settlement—Yuma. The town and county Yuma are named after an Indian tribe, as are nearly all of the fourteen counties in Arizona.

Many interesting tales are told of Yuma and its environs, and there was a time when Californians were not welcome there. Those were the days when the east line of California lay east of the Colorado and followed the center line of First Street in present Yuma. The San Diego County Assessor and Tax Collector at that time collected the taxes of about half of Yuma. The citizens finally ran the interloper out, picked up the border line and placed it in the center of the Colorado since when they have been living in peace with their neighbors. Just when the new border was officially accepted does not appear to be a matter of record in Yuma, but Californians no longer argue the point with their Arizona brethren, who state that Boot Hill in Yuma is filled with lost souls who were hard to convince.

When Yuma was a stage stop, instead of a railroad station, and while railroads were building in the vicinity of Phoenix and Maricopa to the north, a sign hung in the stage station warning the incomer to conduct himself peaceably. The sign was inscribed "100 miles from a railroad; half a mile from water, and 6 inches from Hell. Step light stranger or you'll fall through." The warning was not overly veiled. The statement is, and was at that time quite true, if one can call what flows past the city in the Colorado River, water. It has been designated as too thick to drink and a little too thin to plough, but its muddy enough so that you cannot sell any native born Yuma citizen on the idea that walking on water is such a miracle.



(Incoming) *G. A. Rhoads, Supt. Public Utilities Safford, Ariz.*

(Retiring) *A. W. Miller, Engr. Johns-Manville Phoenix, Ariz.*

In any event, Yuma was host to 120 members of the Arizona Sewage and Water Works Association, Californians and guests from other parts, on March 21, 22 and 23, and extended the well known southwestern hospitality in great form. Mayor Ingalls, speaking on behalf of himself and the City Council, told the visiting delegates that Yuma had "saw the elephant and hern the owl" and that there was little any one could do which would surprise or shock the peace officers of that town; therefor to go to it—have a good time—and come back as often as possible. Chief of Police Isaac Polhamus suspended all the ordinances, insofar as the delegates were concerned, excepting those relating to murder and arson, said that his boys needed some practice and dared the visitors to turn in riot calls or anything else they wanted to do. Despite all of these proffered liberties, one or two parties to San Luis Rey and a real southwestern "baile" (dance to you easterners), the Association turned in two and a half days of intensive study, discussion and caravans to nearby points of interest. Out of state visitors came from as far east as Chicago, including most of the intervening states between Illinois and Arizona, and drew a large number from California and the west coast.

The Elks Club was Convention Headquarters. Registration the morning of Mar. 21 was followed by business meeting and committee reports. Technical sessions continued until Saturday noon, with Saturday p. m. devoted to a Round Table. The meeting wound up in a barbecue (the meat for which, by the way, had been cooking for two days in an open pit) and a dance. Sunday morning, the 23rd, the group "caravaned" to the neighboring synthetic Zeolite works, where Arid zone is made, thence to the Imperial Dam, the vast all-American Canal inlet and the Laguna Diversion.

The new officers elected for the following year are:

President, Guy A. Rhoads, Supt., Utilities, Safford.

The Meeting Place. Yuma's Elks Club.

*Chief engineer and manager, County Sanitation District of Los Angeles. Now on leave, serving in connection with the national defense program in Washington.

(1)—The Secretary-Treasurer, Carlyle Roberts, Jr., State Sanitary Engr., Phoenix; L. E. Northrop, Neptune Meter Co., Los Angeles; Bernard Schiller, San. Engr. of Yuma County, who had charge of local arrangements. (2)—L. R. MacFarland of Los Angeles; Phil Martin, Supt. Water and Sewerage, Tucson; Wm. W. Hurlbut, Chief Engr. and Asst. Genl. Mgr., Dept. of Water & Power, Los Angeles. (3)—Wm. J. O'Connell, W. & T. Co., San Francisco; R. F. Goudey, Chief Sanitary Engr. Water Dept. of Los Angeles; B. W. Phelps, Director, Dept. of Engineering, San Diego, Calif.

1st Vice-Pres., Geo. W. Seeley, City Manager, Tucson.

2nd Vice Pres., Richard Bennett, Water Supt., Phoenix.

Secy. Treas., F. C. Roberts, Jr., State Sanitary Engineer, Phoenix.

Directors: A. W. Miller, Johns-Manville, Phoenix; P. J. Martin, Jr., Water Supt., Tucson; A. L. Frick, Jr., Wallace & Tiernan Co., Los Angeles; Cavett Robert, Vice Pres. Arizona Edison Co., Douglas; H. D. Hall, Disposal Plant Supt., Grand Canyon; Bernard Schiller, County Sanitary Eng., Yuma.

Douglas, down in the mining territory in the southeastern part of Arizona, was chosen as the fall meeting place.

Business Meeting

At the business meeting, C. W. Hercock reported for the Certification Committee that his group had classified water and sewer plants of twelve cities over the state, and had graded the operators; they had issued certificates to forty-six individuals, several of whom qualified as both water works and sewage plant operators. A total of 65 certificates have been issued to Arizona operators to date. Certification in Arizona is voluntary and individuals are rated on character, education, experience and physical condition. Their habits of study are investigated and they are classified in accordance with the type of water works or sewage treatment plant which they operate and in which they are experienced.

Professor E. S. Borgquist of the University of Arizona, chairman, Short Course Committee, reported that for the first time the Association would conduct a sewage and water works operators short school at the University of Arizona in Tucson during spring vacation in April. Subsequently, following presentation to him of a certificate of life membership, R. F. Goudey of the Water Department of Los Angeles, California, was requested to attend and conduct the sessions of the short course.

A. W. Miller, addressing the Association as its outgoing president, commented that A. S. W. W. A. has remained strictly non-political, its objectives being solely the advancement of technical and practical knowledge regarding water supplies and sanitation. It had always endeavored to minimize the influence of those who attended for commercial purposes; does not want conventions at which commercial displays are featured, and that its meetings are of the nature of conferences. Responsible for the excellence of the Association Bulletin, and as the proficient Secy.-Treas. of the Association, Carlyle Roberts, of the State Department of Health, came in for high praise from the retiring president.

Invitations for the fall meeting were received from substantially every Arizona city large enough to accommodate the group and also from two cities in California—a situation of marked contrast with the efforts made by Sewage Works Associations in the west to find a place to hold their meetings in the years past. It is recalled by the writer that a number of California cities, who now bid for the California Sewage Works Associations annual convention, refused to countenance such a thing in their city in the late twenties when the Association first entered the field.

Papers and Discussion

"Repairs in a Small Water Works System," by Guy A. Rhoads, Supt., Municipal Utilities System, Safford, Arizona.

The speaker stated his definition of a repair to mean "fixing an object for reuse after it had become unuseable," and went on to say that a penny's worth of maintenance is worth a pound's worth of repairs. In adjusting his auditors' sights to the magnitude of a small water works such as that which he operates Mr. Rhoades said the system of Safford compares to that of Phoenix in about the same manner as that of Phoenix compares to New York; and in speaking of a small system he meant one which was in reality very small. His paper was largely a description of operating experiences in Safford.

Rhoads said that while in a large system repairs could be standardized and the various details apportioned to men well equipped and quite familiar with their individual jobs, a small system's operator had to be a jack of all trades. He said this was probably the reason why no one had ever written, or ever could write, very much of an article descriptive of small plant repairs. The small plant men have to be individualists—they have to be able to do most anything with the tools which are at hand, and of which latter there is usually a dearth because of the high cost of much of the more efficient repair equipment.

The speaker continued that much information for the small system repair man is available, but that it must be searched out in text books, trade journals, catalogs, bulletins, and gleaned from meeting discussions, consolidated and filed away for ready reference. Mr. Rhodes stressed the necessity of records. "A repair," he said, "breaks down into three steps: preparation, procedure and the record. Of the three, the record is of the most permanent value. If it is not well kept, the system will suffer, and it forms the basis of plans, purchases and emergency measures. It must be reliable and tell the truth." He warned against reliance on memory alone as being fatal to the success of the repair man.

"Yuma's Water Works," by C. G. Ekstrom, Mgr., Arizona Edison Co., Inc., Yuma, Arizona.

Not so many years ago the water works of the City of Yuma consisted of Colorado River fluid poured into a barrel in the back yard, allowed to settle, and the supernatant liquor placed in an "olla." In fact,

the father of the present Chief of Police ran the water works in 1856, and that's the way it was run. Subsequently, in the early 1900's, a small system of pump lines was built from the river to a settling reservoir on a neighboring hill, but when the Gila River broke its banks in 1916 and ran four feet of water through the streets, much of this and other public property was destroyed. The system was repaired and operated in a desultory fashion until 1925, when it was purchased by the Arizona Edison Company.

For three and a half years the Yuma Water works was nothing to brag about. In 1935, the Arizona Water Company, Inc., purchased the system and has been operating it since through the Arizona Edison Company. It now furnishes an average daily flow in excess of two million gallons to the citizens of Yuma. Water is pumped from the river to Blaisdell filters at the city water works, filtered, chlorinated and pumped directly into the distribution system—a tank in a neighboring hill floats on the line. Water is hard, as is customary in the Southwest, and no effort is made to soften.

"Developments in Zeolites," by R. F. Goudey, Sanitary Engineer, Department of Water & Power, Los Angeles.

Mr. Goudey spoke extemporaneously, illustrating his discussion with lantern slides depicting mainly the action of various zeolites in removing bases and acids from water.

He said that Arizona, like all of the Southwest, is a hard water area and that water softening could undoubtedly be practiced with economy in any part of the state. He complimented those present by stating that in two respects Arizona was outstanding in the water works field: first, because it was the home of the Blaisdell filter washer, which steps up capacity from 4 to 30 million gallons per acre per day; second, because the best of the synthetic zeolites in the country was being manufactured in the Yuma area. He then said that zeolite was first used in this country in 1906, the natural greensand in New Jersey; that the comparatively low capacities of the natural zeolite (around 1000 grains per cubic foot) were increased by processing to 2800 grains per cubic foot; that today about half of the water softening plants using the zeolite process employ natural zeolite and half synthetic. The first plant to use artificial zeolite was South Orange, in 1928. The synthetic product, Mr. Goudey described as a "jell," with a capacity of 8000 to 12,000 grains per cubic foot. Zeolite filters he described generally as having flow rates of 8 gallons per square foot per minute, with average periods of forty minutes for regeneration, and 20 minutes for backwashing. He said that about one-half pound of salt per thousand grains of hardness removed was required for regeneration; that although 0.3 pound was at times advertised, it was practically impossible to achieve except under the most favorable circumstances. In the use of artificial zeolite he recommended adjustment of the pH to about 7 to prevent synthetic zeolite disintegration and loss. Twenty-five million gallons of water per day is softened with the zeolite process in the United States.

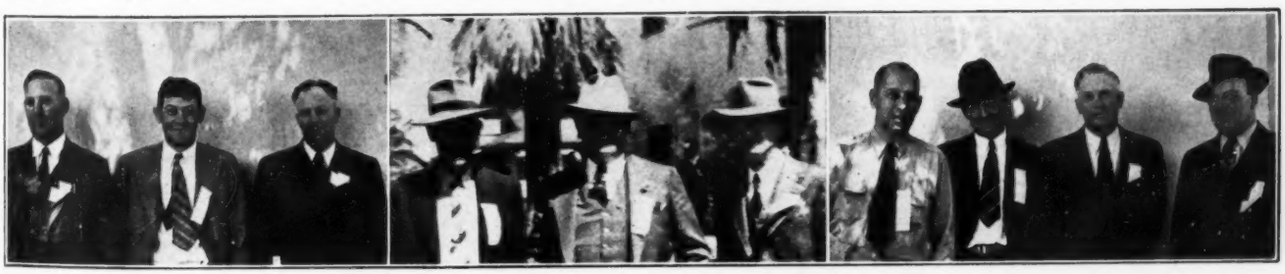
"The average cost throughout the United States," said Mr. Goudey, "for zeolite softening is $5.60 per million gallons. Excess lime," he said, "for removal of temporary hardness, and zeolite for permanent hardness, is economical."

Mr. Goudey then described the new so-called hydrogen zeolites for removal of all minerals, including sodium. He described the regenerating process employed, and illustrated his remarks with diagrams indicating how the cation removes the calcium, magnesium and sodium; how the CO_2 produced may then be removed by aeration. The hydrogen zeolite method does not, however, remove silica, boron and fluorine. While the cost of treating water by this new process is high, water may be produced which is almost the equivalent of distilled water in quality, hence this zeolite finds ready acceptance in modern boiler feed water production.

Mr. Goudey closed with a word of warning regarding the use of ordinary base-exchange zeolites where the treated waters are to be used extensively for lawn and crop culture, stating that the exchange of sodium for calcium and magnesium tends to upset the sodium-calcium-magnesium ratio and raise the per cent of sodium so high as to impair the quality of the soil and ruin certain crops. When the ratio of sodium to calcium and magnesium is in excess of one-half, the water is reaching a dangerous quality for horticulture. However, the use of the most appropriate zeolite to produce a treated water at zero hardness, and the subsequent blending of such water with the natural supply, to produce the desired composition, gives promise of a more extensive use of these rather costly products. Mr. Goudey concluded his remarks with the statement that the City of Los Angeles could probably soften its water by this scheme at a cost of $20 per million gallons.

"Operating a Dunbar Sewage Filter," by W. Daley, City Manager, Tempe, Arizona.

The sewage disposal plant of the City of Tempe—Imhoff tanks followed by a Dunbar filter—is designed for a population of three thousand, and a capacity of 340,000 gallons per day. Although no chemical analyses are kept of the effluent, Daley reported that it is clear, odorless and stable. The Dunbar beds, built in the customary manner of such structures, are 112′x100′x5′ in depth. The beds are divided into three bays—the sequence of operation being that



(1)—Delegation from Tempe, Ariz.: Delworth Baird, City Clerk; Frank Reeves, Commissioner, and City Manager E. W. Daley. (2)—Three "go-getters": B. W. Phelps, City Engr., San Diego, Calif.; Dario Travaini, Supt. of Sewage Treatment, Phoenix, and D. R. Kennedy, Supt. of Construction, Long Beach, Calif. (3)—From Mesa, Ariz., came this foursome: E. B. Tucker, City Engr.; B. Jones, Chief Plant Operator; the Mayor, George Goodman, and City Manager Ed. Miller.

(1)—Professors E. S. Borgquist, Univ. of Arizona, Tucson, and Leon B. Reynolds, of Leland Stanford Univ., California. (2)—In charge of registration: Anna M. Flannery of the Arizona Dept. of Health, assisted by Mrs. U. R. Dempwolf. (3)—Yuma's Police Chief Polhamus, who said all city ordinances were suspended for the duration, and Tempe's City Clerk, Delworth Baird—both old-time Arizonans.

while one operates, one is drying out, and the third—already dry—is being raked, cultivated and prepared for operation. The plant cost the city $265,000 and was built under the sponsorship of the PWA.

The speaker did not report upon the cost of operation but stated that it consumed the time of one man, a comparatively small amount of power, and almost no additional expense of upkeep. Preliminary subsidence ahead of the Dunbar beds is effected in an Imhoff tank.

"Protective Coating on Sewage Plants," by Dario Travaini, Supt., Sewage Disposal Plant, Phoenix, Arizona.

Mr. Travaini said that, in his opinion, and at the risk of injuring the feelings of some paint manufacturers, he was compelled to admit that for use in a sewage treatment plant some paints were not as bad as others. He discussed the paints used in the Phoenix activated sludge plant: said that it was impossible to use lead paints in the area because of hydrogen sulphide gas in the air and consequent lead sulphide discoloration. He said that on the outside of buildings cold water paint failed in twelve months. Varnish outdoors is unsatisfactory; it cracks and checks—probably as much because of the excessively high temperature of the area as for any other reason.

In the screen house he has not yet been able to find a paint which will stay in place any considerable length of time. He commenced painting the screen house with aluminum paint in 1933. So far as the wood work in the building was concerned, the metallic paint was satisfactory. It was not, however, when applied to the metal parts. For floor covering, he applies linseed oil first and then covers with aluminum paint with best success. Just above the sewage level in the tanks he had greatest success by applying a coat of red lead and then two coats of aluminum paint. On walk ways, railings, etc., aluminum paint is best but needs to be applied with great frequency on the walkways.

Concluding his remarks, he stated that no paint that he had been able to find was satisfactory for the aeration paddle-wheels or metallic parts and equipment coming in contact with or under the sewage levels; that he felt the answer in such instances was to find some substance which would not require painting, but which of itself was resistant to corrosive action of sewage.

Discussion of this paper from the floor fortified Travaini's opinion that the aluminum paint was the best material to use. It was stated that all standard brands appeared equally satisfactory.

"Programming Chlorination for Best Results," by W. J. O'Connell, Jr., Wallace & Tiernan Sales Corporation, San Francisco, Calif.

O'Connell said that programming chlorination might be defined as the work of regulating the amount of chlorine used with the times for changes in the schedules of chlorination; that the success of such operation was not dependent upon averages or mediums, but upon consideration of flows in terms of short period variation.

"Programming of chlorination," said O'Connell, "is inseparably associated with the selection of the best form of chlorination." In this connection he cited the Hetch Hetchy and Detroit Water Works and the Richmond-Sunset sewage treatment plant in Golden Gate Park, San Francisco. In the last named plant, chlorine is used to control pollution of beach areas when the latter are in use.

Mr. O'Connell discussed at length slime growth control in open and closed circulation systems. He said that sulphur dioxide gas, dust and organic matter in the re-circulation water were matters which influenced the chlorine demand and that chlorination must be programmed to maintain a .5 ppm residual at all times for good results. Where water was not re-circulated, the program clock applying chlorine for twenty minutes in each 3-hour period was usually enough to prevent slime formation.

The speaker stated that the first time-rate control for chlorinating sewage was developed in Tucson, Arizona; followed shortly by that at the Tovrea Packing works at Phoenix; that it had come into common use since that time, but that the time-rate application of chlorine and ferric chloride to Tucson sewage was pure pioneering. He described the Yountsville, California, Veterans Home, where a highly oxidized effluent from a sewage treatment plant has substantially the same characteristics at all times. To the effluent, chlorine is applied in direct proportion to the rate of flow, while another branch of the clorine equipment treats the incoming sewage proportionately to control odor.

"Programming in sewage treatment plants," said O'Connell, "may be related to three uses; odor control, sterilization and coagulation." Program chlorination in the sewage treatment plant may not vary directly with the rate of flow or sewage strength, but upon analysis of the needs in the plant and of the effluent, frequently indicating that the greatest rate of chlorination must be applied when the lowest rate of flow is coming into the plant.

"Bearings and Motor Maintenance," by John R. Read, Westinghouse Electric Mfg. Co., Phoenix.

It is generally conceded that proper bearing lubrication is of first importance in motor maintenance, regardless of the size of the motor. This is no better emphasized, said Mr. Read, than by the fact that analysis of induction motor failures shows bearings to

be the principal offenders.

He continued that the most universally used bearing is the sleeve type, which, although it has a higher starting friction than a ball bearing, it exhibits negligible running friction. Sleeve bearings usually require little or no repairs in many years of service. When there is trouble, such is most often traced to one of the following causes: (1) Presence of dirt in the lubricant; (2) improper alignment or excessive shaft deflection; (3) use of incorrect grade of lubricant; insufficient quantity or improper operation of oil ring; (4) under designed bearings.

Mr. Read also remarked that oiling of bearings is more often over, than under, done. Generally the oil for a sleeve bearing is contained in a reservoir below the bearing and is lifted to the journal by an oil ring. Adding oil through the overflow gauge when the motor is *at rest* will eliminate the possibility of too much. It should not be necessary to add oil more than once or twice a year. For most motor bearings a good quality of lubricating oil, which will not sludge or gum under operating temperatures of 80° C. and having a Saybolt viscosity of 280 at 40° C. will be satisfactory.

Ball and roller bearings give good service when properly maintained; however, they are sensitive to mistreatment. In placing the bearing, keep it in its original carton until the workman is ready to install it. When a motor is disassembled for any reason, always wrap the bearing in a clean cloth or wax paper. Never wipe it off with a dirty rag or place it on a work bench unprotected. From one to three ounces, depending upon the size of the motor, is sufficient grease for a ball race. If the bearings are over greased high temperatures result and the grease breaks down. This has been a common difficulty, since many do not realize that there can be such a thing as "over lubrication."

It is a good plan, suggested Mr. Read, to open up the bearing every two years and clean thoroughly. He cautioned against attempting to clean the housing without disassembly, i.e., by adding a solvent running the motor and draining. A dry, flaky residue is, thereby, often left in the bearing to act as an abrasive thereafter.

Ordinary cup greases are not satisfactory for ball bearings. Those to be used should be composed of pure mineral oil and sodium base soap, free from dirt and fillers such as powdered mica, flake graphite, etc., and should not melt at the highest operating temperature of the bearing.

"Telling the Water Works Story to Non-Technical Folks," by Cavett Robert, Vice-President, Arizona Edison Co., Douglas, Ariz.

Mr. Robert, who had made such an eloquent plea for his home town the previous day as to win the fall meeting of the organization, prefaced his remarks with a statement that Douglas, in 1940, had more water—and better water, and more taxes and less dividends than ever before. He then proceeded to tell the story of water as he would like to describe it to non-technical individuals.

He described its effect upon the earth; the world in which we live; the materials and things with which we do; their combination in chemistry—finally stating that we live a "living stream of water"; that the life time consumption and use by a single individual in these modern times is a staggering amount. Being the most abundant thing in the world, were the surface of the earth all levelled out it would be covered two miles deep with water.

He then traced water by the usual routes of evaporation, drifting, condensation, precipitation to the land; noted the tremendous pressures which were exerted when this phenomenal material freezes; spoke of how it had thus been used in times past for stone splitting in quarry work; elaborated eloquently upon the beauty of the desert surrounding Douglas after a rain storm, and closed with the remarks that it was up to the water works operator to spread the gospel of water in simple words in order to increase consumer interest in the water works job and keep him mindful of the pure water which is being furnished the community at so little comparative expense.

"Complete Sewage Treatment," by J. A. Montgomery, Lakeside Engineering Corp., Chicago.

Mr. Montgomery briefly described the oxidation process following plain subsidence, laying particular emphasis upon the trickling filters which had stepped up oxidation. He described the high capacity filters now increasingly employed, contrasting them with the standard low rate trickling filter of the past.

Of particular importance in Montgomery's remarks were the differentiations between rate and capacity. He stated that a filter which embodied recirculation of a large portion of filter effluent should be classified as a high-rate high-capacity filter, because the rate of application has been vastly increased, but at the same time so had its capacity in terms of purification. Similarly, a filter in which the filtering media were aerated and the effluent recirculated might be similarly deemed of high rate and high capacity, but that the type of filter where the distribution was carefully controlled to apply small amounts of sewage to the entire surface of the bed and with no recirculation of effluent was a low-rate high-capacity filter, in that the rate of application, although continuous, is actually lower than rates of application through intermittent dosings, whereas the capacity was high. The ordinary old type of trickling filter with rotat-

(1)—H. H. Idle and C. G. Ekstrom, Arizona Edison Co., Yuma. (2)—A group between sessions. (3)—W. A. Bush of Parker, Ariz.; Cavett Robert of Douglas, and R. W. Cushing of Phoenix.

ing arms at the quadrant points might readily be termed a high rate low capacity filter because so little of the filter was being dosed at any given moment.

He deplored the use of the term "rate," in describing the ability of the filter bed, and his explanation made it clear that "capacity" was a far more meaningful term.

Mr. Montgomery stated that the high capacity filters were using comparatively shallow beds of moderately large sized rock. He discussed the problem of filter flies—said that, while they might not be as prevalent in the air around the high rate filter as elsewhere, an examination of the effluent would indicate that there were just as many in the bed. He also pointed out that the tendency to unload at periodic intervals was not as great in the high as in the low capacity filter.

Asked if a Dunbar filter bed might be modified to use it as a high-capacity filter, he stated that, for obvious reasons, principal among which was the small size of the upper filter media, it probably could not.

"Report on Formation of New Federation of Sewage Works Association," by A. M. Rawn, Chief Engineer and General Manager, Los Angeles County Sanitation Districts, Los Angeles.

Mr. Rawn discussed the Federation meeting in January in New York, stating that the constitution of the new Federation had been unanimously adopted by all present with the proviso that membership classification would be so adjusted as to permit Association members to participate in their local groups as members without the necessity of contributing dues to the National Federation. However, those not paying dues for membership in the Federation would not receive the Sewage Works Journal.

Mr. Rawn explained that it was necessary to get the new national organization rolling before the beginning of 1942, at which time it would be advisable to raise membership dues in order to provide funds for carrying on a centralized organization's activities and the publication of the Journal without incurring a substantial deficit.

Following Rawn's remarks, the Association adopted a resolution to the effect that the proposed amendment appearing in the February issue of "Water Works & Sewerage" was unsatisfactory and that the Arizona Association would not subscribe to the Federation's constitution until such time as there was embodied therein an amendment to the effect that there would be no distinction in the local organization between sewage and water works men, or any members who might not desire the Sewage Works Journal.

Luncheon Address by Hurlbut

The technical sessions closed at noon on Saturday. At the luncheon meeting W. W. Hurlbut, past president of the American Water Works Association, described the local activities of Water Works Association Sections. He said that he hoped Arizona would, in the not distant future, organize and support its own local section, but that in the meantime urged them to join with and participate in the activities of the California group, to which they were at present assigned.

The afternoon session on Saturday was devoted to a round table discussion of all that had gone before, continuing from two o'clock until 5:30 o'clock p. m. It proved of great interest and of material value in clearing up questions about which members had been perplexed in the original presentation.

The Sunday morning caravan included an inspection of the Yuma Water Works, the Arid-Zone zeolite plant, the Laguna and Imperial Dams on the Colorado River, and the head works of the All-American Canal.

FORT WORTH-UVALDE-HAMLIN HONOR TEXAS CITIES

The pioneering Water and Sewage Works Operators Short School was that established 23 years ago in Texas. This year at Texas A. & M. College was held the 23rd Annual Short School which brought to college station a record attendance of 300.

A feature in recent years comes at the close of these Short Schools, when the State Health Officer appears in person to announce those communities rated highest in the state for sanitary improvements during the year. This year the "Honor Roll Cities" announced by Dr. Geo. W. Cox, State Health Officer, were:

(1) Fort Worth—That Texas city having maintained the best sewage effluent during 1940.
(2) Uvalde—for having made the greatest improvements in their sewage treatment plant.
(3) Hamlin—for having made the greatest improvements to their water purification plant.

Special trophies were awarded each of these cities. The accompanying photograph shows W. S. Mahlie, Supt. of Water and Sewage Treatment at Fort Worth, receiving from Dr. Cox the trophy for the highest quality sewage effluent consistently maintained.

Plaque went to the Rio Grande Valley Water Works and Sewerage Association for having the most members of any of the sections at the Short School.

For outstanding services to the Short School, on Prof. E. W. Steel of A. & M. College, and D. B. Dickson, the retiring president of Wichita Falls, were conferred Honorary Life Memberships.

V. M. Ehlers, Chief Engr. of the Texas State Dept. of Health, organizer of the Short School, was re-elected secretary for his 24th term.

As the new president S. C. Clark of San Benito was chosen.

ACTIVATED SLUDGE BULKING*

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A NUMBER of views have been advanced concerning the causes of bulking. The only agreement in respect to these views is the invariable bulking of activated sludge when treating carbohydrate wastes. The more common cases of bulking are encountered when such carbohydrate wastes cannot be detected in strictly domestic sewage. For the explanation of bulking under such conditions the most commonly held view is that underaeration is the factor responsible. However, certain difficulties arise in uniformly applying this explanation to plant observations. The most obvious difficulty in this respect is the fact that a given plant will undergo periods of bulking followed by periods when the sludge settles readily with the same air input. The dry weather flow has been blamed for such anomalies. The indefiniteness of these views is to be attributed to the fact that under plant operating conditions it is difficult to control all factors which must be taken consideration of. The variables that may influence the results are: the change in the strength and volume of sewage, character and the amount of sludge carried, and sewage temperature. These factors could be more readily controlled under laboratory conditions and varied one at a time to determine the effect of a single factor on the sludge index. Unfortunately all previous attempts to produce a bulky sludge have met with failure under laboratory conditions with carbohydrate-free sewage. The reasons for this are at first not obvious, but a closer comparison of the methods of operation at the plant and the laboratory study will make them apparent.

Deficiencies of Laboratory Scale Studies

At the plant the sewage and sludge flow through the aeration tank continuously, whereas, under laboratory conditions aeration is conducted under a batch process. In a continuous flow tank there is considerable short circuiting and core formation whereas in the laboratory mixtures, this factor is completely eliminated. Furthermore, under laboratory conditions if

the air supply is reduced proportionally with the volume of mixtures employed, to secure approximately the rate of 1 cu.ft. per gallon, the air would not be sufficient to keep the sludge in suspension. Therefore, it has been convenient to overlook the volume of air utilized and adjust it to flow at a rate required to keep the sludge in suspension. The result has been a consumption of air three to four times as high as under plant conditions. The air has seldom been metered.

In view of the admitted importance of air in the activated sludge process, this has been a serious oversight. The reasoning behind this has been that in aeration tanks, already more air is supplied than can be utilized; therefore, if doubling or tripling the air supply in the laboratory such will have no influence on the results. But the assumption that since most of air supplied is wasted, and that the sludge is obtaining all the oxygen it requires, is open to question. It is conceivable that due to the slow rate of solution of oxygen and the high oxygen demand, there may be a deficiency of oxygen even in the presence of abundance of air. The anaerobic character of sludge deposits in a flowing stream serves as an illustration of how easy it is to have spots of oxygen deficiency in aeration units.

Since it was realized that sludge may not bulk with a single dose of sewage under laboratory conditions, applications of sewage have been made only once daily. Due to the long aeration period obtained with such a procedure the doses have been increased to twice daily, giving an aeration period of 10-12 hours. However, to get even remotely comparable results at least three daily doses should be made.

Devising a Means of Controlling Air Input

From the above discussion it is apparent that air supply is one of the most important factors and that in laboratory work it has not been adequately taken care of. The specific problem, therefore, was how to reduce the input of air to values comparable to plant practice and still keep the sludge in suspension. Two possibilities suggested themselves. First, to use mechanical means for agitation and to supply small amounts of air as the source of oxygen; second, to dilute the air with nitrogen and to pass the gas mixture in rates high enough to keep the sludge in suspension. The latter procedure was selected as the most convenient for laboratory application. It was realized at the outset that by this procedure the partial pressure of oxygen and thereby the saturation value of the oxygen in the sludge mixture would be changed but since saturation values are seldom obtained in the activated sludge mixtures this factor was temporarily disregarded.

An apparatus was assembled by means of which a gas mixture containing a given percentage of oxygen could be made and stored in a 30-gallon capacity water tank, by adding definite quantities of air and nitrogen as indicated by the pressure gage. The gas mixtures were passed through two pressure reducing valves in order to maintain a constant flow of gas and through needle valves to regulate the flow into sintered glass crucibles fitted into the bottom of the aeration tubes. The actual flows were determined by calibrated glass orifices which produced a differential pressure proportional to the flow. A more detailed description of the apparatus will be published later in the *Sewage Works Journal.*

The operating schedule was on a fill and draw basis with three doses a day. Aeration periods were approximately 6 hours for the two doses and 10 hours for the night dose.

The sludge index values were calculated according to Mohlman by ob-

* Journal Series Paper, N. J. Agricultural Experiment Station, New Brunswick, N. J., Div. Water and Sewage Research.

taining the volume in per cent of settled sludge after one-half hour sedimentation and dividing it by the suspended solids concentration of the original mixture, in per cent by weight.

Results

When the oxygen content of the air was reduced to 5 per cent and passed through two sludge mixtures at different rates the revealing results presented in Table I were obtained. The highest increase in sludge index took place with the higher sludge concentration and the lowest amount of air. The sludge index values decreased regularly with increasing amounts of air at both sludge concentrations. The initial sludge index values could not be maintained even with the low sludge concentration (975 p.p.m.) and high amounts of air. That, with a still lower sludge concentration the initial sludge index might have been maintained, is indicated by a subsequent experiment where with an initial suspended solids concentration of 400 p.p.m. aeration with 5 per cent oxygen in the gas mixture at the rate of 0.96 cu.ft. air per gallon of sludge mixture gave an initial sludge index of 125 and after three doses, a sludge index of 122.

Two factors were indicated from these experiments as having an important bearing on sludge bulking when the sewage load factor was kept constant:

(1) Suspended solids concentration in the aeration tank mixture,

(2) The quantity of air supplied.

Sewage Load Factor

The factor of sewage load was investigated as follows: (a) To a portion of activated sludge sewage was applied three times a day, (b) to a similar portion of the sludge sewage with one-third original strength was applied three times a day, (c) to a third portion of the sludge normal strength sewage was applied once a day. The volume of sewage applied in each case was equal. Six such doses were made in each case. Therefore, (b) and (c) portions received exactly the same quantities of sewage while (a) received three times as much sewage. Aeration was accomplished by 5 per cent oxygen gas mixture at the rate of 1 cu.ft. of air per gallon of sewage in 6 hours. The results in Table II indicate that the greatest increase in sludge index occurred with the application of full strength sewage three times a day. Of greater importance is the fact that when equal loads were applied the more frequent application of dilute sewage resulted in a decrease from the original sludge index while the application of strong sewage at less frequent intervals resulted in an increase from the original index.

TABLE I

Effect of Different Rates of Application of 5 per cent Oxygen Gas Mixture on the Rate of Bulking at Two Different Sludge Concentrations

		Suspended Solids		Settling		Sludge Index	
	Cu. ft. air/gallon[1]	Initial	After 3 doses	Initial	After 3 doses	Initial	After 3 doses
1	0.72	2245	1995	25	61	110	306
2	1.08	2245	1930	25	50	110	259
3	1.44	2245	2020	25	39	110	193
4	0.72	975	1035	8	23	82	222
5	1.08	975	1040	8	18	82	173
6	1.44	975	970	8	13	82	134

[1] On the basis of air containing 20 per cent oxygen and 6 hours aeration period.

TABLE II

Effect of Strength of Sewage and Aeration Period on the Bulking of Activated Sludge

	Suspended Solids		Settling		Sludge Index	
	Initial	After 3 doses	Initial	After 6 doses	Initial	After 6 doses
Full strength sewage 3 times a day	1100	1360	14.0	48.0	127	350
1/3 strength sewage 3 times day	1100	1065	14.0	12.0	127	113
Full strength sewage once a day	1100	1170	14.0	17.0	127	145

Discussion

In the July, 1938, issue of WATER WORKS & SEWAGE this author has made certain observations on the factors governing the maintenance of dissolved oxygen in the activated sludge process. It was stated that the maintenance of dissolved oxygen was determined by the resultant of supply and demand. The supply is governed by the type of aeration mechanism and the quantity of air supplied. The demand is governed by the strength and quantity of sewage and of the sludge returned. It was further pointed out that sewage does not have a high saturation value nor as rapid an oxygenation rate as pure water. These observations were made from the standpoint of their effect on purification of sewage by activated sludge. Now we are able to apply these same observations to the bulking phenomenon. It is our contention that bulking is intimately connected with the purification process. If for any reason purification is seriously hampered there will be no bulking. For instance if nitrogen gas is passed through the activated sludge mixture, purification is poor and bulking does not occur. In other words, bulking does not occur in the complete absence of aerobic conditions. Neither does bulking take place when there is more than ample oxygen supply as is indicated by the failure of sludge to bulk under laboratory conditions with unrestricted air supply. Purification in this case reaches the same value in 2-3 hours as under plant conditions within 6-8 hours. It therefore follows that if it were possible to dose with sewage at 2-3 hour cycle throughout a number of days, bulking might be brought about even with air under laboratory conditions. Since this would require a 24 hour attendance it was more convenient to dilute the air supplied with nitrogen gas, deliver an equivalent quantity of oxygen on the basis of the volumes of the mixture treated as under plant conditions, and dose it only three times a day. The results, a few of which are given in this paper, were revealing. There was a definite relation between the volume of the diluted air supplied and the sludge index. Furthermore, the higher the concentration of sludge the higher was the sludge index at a given oxygen input, indicating that for the strength of sewage employed the quantity of oxygen supplied was not sufficient to meet the demand created at the higher sludge concentration. Therefore, when the oxygenation capacity is limited due to mechanical methods of aeration or when economy in air supply is required, the concentration of sludge in the aeration chamber should be reduced.

The strength of the sewage is an important item in sludge bulking when the oxygen supply is limited. With the same amount of load applied the frequent dosing with a dilute sewage resulted in no increase in sludge index while dosing less frequently with strong sewage gave an increase in sludge index and indicating approach of bulking. In plant practice the sludge receives its full load at the inlet end of the aeration tank. The high oxygen demand of the

mixture often gives rise to the complete depletion of dissolved oxygen during the early periods of aeration. As purification proceeds the oxygen demand decreases and dissolved oxygen appears in the aeration tank mixture. Tapered aeration is advocated to meet this situation. However, it seems that a more uniform distribution of the sewage in the aeration tank by inlet ports located along the forward part of the aeration tank would more adequately solve the problem by regulating the oxygen demand rather than by increasing the air supply. It is felt that the absence of dissolved oxygen in the early parts of the aeration period may give momentum to sludge bulking from which the sludge may not be able to recover even when the dissolved oxygen reappears.. At present it cannot be definitely stated as to how long the dissolved oxygen may be entirely absent or how low the oxygen level may sag without exerting an influence on the sludge index. It is however, quite conceivable that even in the positive presence of small amounts of oxygen in the liquor the sludge itself may undergo a partially anaerobic decomposition due to the low rate of diffusion of oxygen from the liquor into the sludge and high rate of oxygen uptake by the sludge. In other words a certain minimum gradient may be necessary to keep the center of the floc aerobic.

The next implication of the effect of sewage strength on sludge bulking pertains to wet and dry weather flows. Assuming an equal sewage load under these conditions the concentrated character of the sewage during dry weather would tend to increase the sludge bulkiness. This is in accordance with many plant observations. Whether the strength of sewage *per se* plays a role in this respect or whether dissolved oxygen carried by the dilution water is a factor, cannot be definitely stated at present. Artificial dilution of the sewage during dry weather with stream water or secondary effluent (recirculation of effluent) would prove of definite benefit. Returning the secondary effluent would also add oxygen in the form of nitrates. The same purpose is achieved by increasing the volume of returned sludge while maintaining a low sludge concentration in the mixed liquor, e.g., by returning a thinner sludge. Dry weather flow in most localities is associated with high sewage temperature which may also contribute to the difficulties encountered. At such times, due to the high rate of biological oxidation and lower saturation values of dissolved oxygen, the air supplied may not be sufficient to meet the demand.

Beneficial effect of chlorination in controlling sludge bulking reported in some plants, may be due to the reduction of oxygen demand during the initial critical period of aeration thus allowing the maintenance of dissolved oxygen.

How does oxygen deficiency cause the sludge to bulk and what is the relationship between sludge bulking and filamentous organisms? Let us consider for the present only the Zoogleal and filamentous organisms. Bulking caused by excessive amounts of carbohydrates is due to the excessive development of the filamentous organisms to energy yielding materials which they can utilize readily. This type of bulking may or may not be accompanied by oxygen deficiency. Zoogleal organisms are at a handicap in this competition for the food. In the absence of carbohydrates when the sludge bulks due to a deficiency of oxygen the zoogleal organisms are again handicapped because they require a higher amount of oxygen for their development than the filamentous organisms. The result again is the preponderance of the filamentous organisms. Filamentous organisms get the ascendancy therefore both in the presence and absence of carbohydrates but for different reasons. According to this view the ultimate result is the preponderance of filamentous organisms. In other words a sludge that has become bulky from either cause has a greater number of filamentous organisms than a sludge which settles well and the worse the bulky condition the greater the number of filamentous organisms.

Conclusions

The important factor in the bulking of activated sludge with domestic sewage free from detectable quantities of carbohydrate wastes is due to a deficiency of oxygen created by the slow rate of diffusion of oxygen from the liquid into the floc and the high oxygen demand within the floc. The remedies recommended are: (1) Maintenance of sufficiently high dissolved oxygen in the mixed liquor to allow a high diffusion gradient to the floc. (2) Maintenance of dissolved oxygen not only at the outlet but also throughout the tank. This may be conveniently accomplished by distributing the sewage load. (3) Maintenance of low sludge concentration in the mixed liquor. (4) Dilution of the sewage with stream water, recirculation of secondary effluents or returning of large volumes of thin activated sludge. (5) Reduction of the high oxygen demand rate during the initial aeration period by careful chlorination of returned sludge or through other means.

RENNIE I. DODD BECOMES MANAGER OF CHESTER WATER SERVICE

As pleasing to his many friends as it is to us we have learned of the deserved recognition accorded a young water works man —a career man is the expression we like to use, and this is a fitting place for the term.

Rennie Dodd

Rennie I. Dodd, former chemist and supt. of filtration at Chester, Pa., has been promoted to the position of Executive Manager of the Water Service, until a short time ago the Chester Water Service Co. when taken over by the city and now operated under the Chester Municipal Authority. Mr. Dodd succeeds E. Fred Muser, who after 10 years as Executive Manager recently passed away.

A Virginian by birth—he won't tell when—Mr. Dodd began his career, following graduation as a Chemical Engineer, in 1920. He went to work for the Federal Water Service Co. and in 1928 was sent to the Chester plant of this company, where he has been ever since. For the position he now occupies out of recognition of his ability as well as appreciation of his exceptional personality, Rennie Dodd is a young man.

Amongst other things to his credit, and responsible perhaps for his advancement to the top, is his interest and work in community enterprises. He is a member of the Chester Club and a past president of the Chester Rotary Club.

In water works activities he is a member of the American Water Works Association and prominent in the Penna. Water Operators Association.

Our prediction is that the Chester Autority will be happy with the choice it has made and that we will hear more of their Executive Manager of Water Service.

CONCERNING THOSE PLUS FERTILITY VALUES OF SEWAGE SLUDGES

Some Convincing Results and Considerations Coming Out of Thirteen Years of California Experiences

By A. M. RAWN
Chief Engineer and General Manager
COUNTY SANITATION DISTRICTS
LOS ANGELES

IT HAS long been recognized by those who have used, or observed the use of sewage sludge as a fertilizer that the value of the sludge in that capacity appears greater than the sum total of its fertilizing constituents, and that its influence in crop culture goes over and beyond anything which the customary analyses as applied to other fertilizers may indicate. Although there is nothing mysterious about these somewhat obscure factors they have not been generally recognized in their true form heretofore. Therefore, the story by Doctor Willem Rudolfs, in the December issue of WATER WORKS & SEWERAGE, in which he separates out values (fertilizer), which react to laboratory analysis, and those (fertility) which are determinable only by observing plant reaction to the fertilizer, is timely and important and should have a beneficial effect upon the future use of sludge.

Some California Experiences

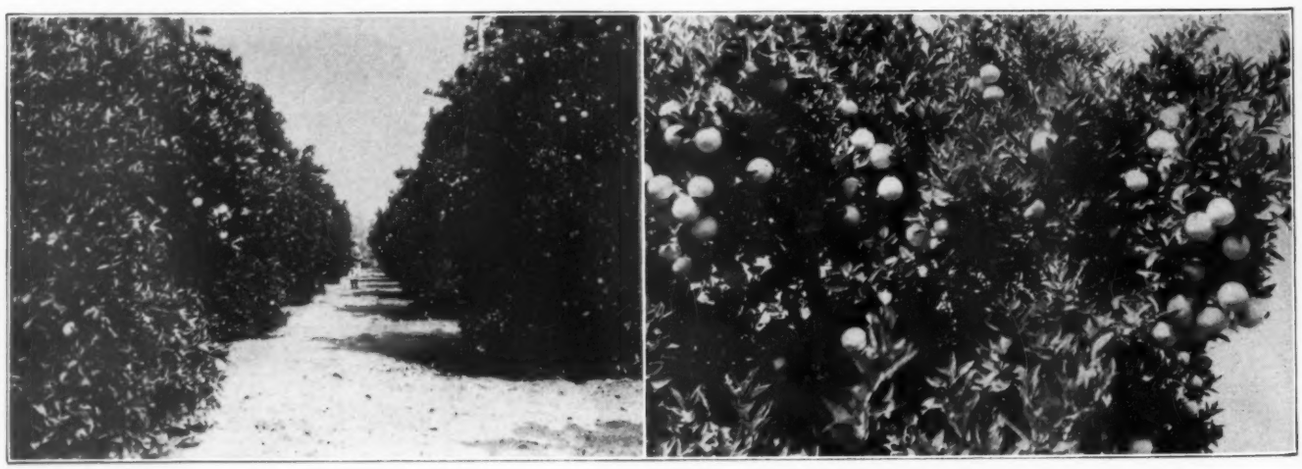
In Southern California there are three sewage treatment plants, each producing a type or grade of sewage fertilizer quite different in composition and characteristics; nevertheless all are finding a ready acceptance in the culture of citrus groves and to some extent in other crops. Each appears to have characteristics, not measurable by laboratory yardsticks, which give them the extra values about which Doctor Rudolfs speaks.

The Pasadena Tri-cities sewage disposal plant has successfully pioneered the sale of dried activated sludge, largely for use in the orange groves of Southern California. Dried, ground and sacked, this material commands the impressive current price of $18.50 per ton and at present yields a return to the disposal plant equal to the cost of production,[1] including all processes from the reaeration tank to and including grinding and sacking. The experience of Pasadena in pioneering the sale of this material has not been a smooth one, but the city seems to have achieved a position in fertilizer industry where the salability of its product is no longer dependent upon overcoming resistance to a sewage fertilizer, but rather upon general fertilizer market conditions. Not only the orange grower but the fertilizer company appears to have accepted "Nitroganic" as more than an ordinary crop producer. This undigested dried activated sludge is guaranteed to contain in excess of 6 per cent total nitrogen; its content of phosphoric acid is about 2½ per cent and its potash less than 1 per cent, as a rule. It has been used for years successfully as the *sole* fertilizer on many extensive orange groves in the San Gabriel Valley.

A. M. Rawn
Associate Editor

The joint disposal plant of the Los Angeles County Sanitation Districts is a large producer of dried digested primary sludge, a material containing between 2 and 3 per cent nitrogen and a comparatively low content of phosphoric acid and potash. Its organic content ranges from 50 to 55 per cent. This material is sold to a fertilizer agency on the open drying beds at a rate which yields the districts about $2 per dry ton. The buyer stands the expense of removing the sludge cake from the beds. It is macerated and sold in bulk to orange growers for about $7.00 per ton at 40 per cent moisture. The material bears the trade name "Nitrohumus" and is advertised as an organic sewage fertilizer. (Figured on a dry basis the price of $7.00 per ton in bulk for a digested primary sludge is worthy of note.—Ed.)

(1) Operation cost only; does not include capital charges.



What "Fertility" Values Mean to California—and, Commercial Inorganic Fertilizers Won't Do It
(Here is a real Southern California grove of Valencias with a record crop top grade oranges. This grove has been fertilized with nothing but shredded air dried digested sludge for twelve consecutive years. Verdant foliage is o.k., but here, on right, is what counts—a well balanced crop of top grade, size and quality of fruit as measured by marketing standards. Truly a luscious sight, and a remarkable testimonial that sewage sludge possesses something more than ordinary fertilizer value.)

What Makes the Product Worth the Price?

"Nitrohumus" has been on the market for thirteen years in one form or another, and the pioneering days with it seem to be over. It has qualities for promoting growth which render it highly desirable. In addition to those mentioned by Doctor Rudolfs, it does two additional jobs, one of which may be readily understood—the other being not so clear. (1) It greatly stimulates growth and propagation of angle worms in the soil, such being recognized as highly beneficial in tree culture; (2) it appears to put inorganic fertilizers "to work" in soils in which they otherwise seem sluggish or ineffective. The proof of the latter has been manifested in citrus groves where sewage fertilizer has succeeded admirably, and where inorganic fertilizer previously applied have failed; and (3) it has stimulated growth much more than might be accounted for by the quantity of sludge applied in terms of commercial inorganic fertilizer values.

Dried Screenings

The third material which is produced in this area is the dried fine screenings at the Hyperion sewage disposal plant of the City of Los Angeles. This material, undigested, is dried in a rotary kiln and hauled thence to the orange groves for direct application. It is highly odoriferous, and quite low in recognized fertilizer constituents. Made up of all the flotsam and jetsam that is carried down a sewer in coarse suspension, it nevertheless is very stimulating to citrus groves. One grove in particular which is illustrated in this narrative, has been fertilized with nothing else than these fine screenings. The trees are planted in a sandy, reasonably sterile soil, and an excellent opportunity is offered for comparison with an unfertilized grove directly across the road. The difference between the two is indicative of the highly beneficial character of this type of fertilizer, which, upon laboratory analysis would appear to be quite worthless.

Some Demonstrations

The effect of digested sludge upon lawn development is extraordinary. One of the tricks in advertising in this area is to request the prospective customer to let the salesman sprinkle a little of the fertilizer on the front lawn. The agent then writes the name of the fertilizer on the grass in fertilizer; asks the prospective customer to water the lawn a couple of times, with the result that in a week or ten days the name of the sludge is written in bright green across the yard. This very effective method of demonstrating the fertilizer's ability has made many sales to a large number of permanent customers.

An experimental garden was operated for several years at the County Sanitation District's plant. The garden soil comprised originally a thick heavy black adobe, upon which it had been observed that the application of wet digested sludge changed the character of the soil so that it became open and friable. The experimental garden was in this case

A Further Testimonial for Sewage Sludge.

(Two Valencia groves that are thriving and two adjacent plantings of identical age that are not. The two upper views are but 200 ft. apart. The only known difference in treatment is that the grove on the right has been fertilized with shredded digested sludge cake and kiln dried fine-screenings for the past several years. The lower views are of two groves separated only by a road. That on left has had no fertilizing; that on right has been fertilized solely with Los Angeles fine screenings. These groves, of the same stock, were planted simultaneously. When considering various experiences, and these long term results with digested sludge, one is convinced that it possesses a plus value which the expressive and inclusive term "Fertility Value" most aptly defines.)

fertilized entirely with digested sewage sludge. Some of the tests were made on pure digested sludge as the seed bed. On this plot three crops of golden bantam green corn were matured in one summer; while in two-year-old sludge alone, the equivalent of 215 bushels per acre of yellow field corn was produced. A yield of 1,500 pounds of field pumpkins were taken from three hills of three vines each. The pumpkins averaged 40 pounds each, with the largest weighing 85 pounds. A lawn fertilized half with ground digested sludge and the other with an equal amount of dairy fertilizer developed twice as rapidly under the influence of the digested sludge as with the other.

Commercial growers of iris, dahlias, gladiolas, pansies and marigold, are among a long list of repeat customers using digested sewage sludge for fertilizer. Dairy manure in this area is now selling for $1.50 per ton, delivered, roadside. This is the commercial variety containing about 1¼ per cent nitrogen. Digested sewage sludge, roadside delivery, is selling for $7 per ton. The difference in selling price is not indicative of high pressure salesmanship; to the contrary—it portrays better than any other factor the difference in value and is excellent proof of the fertility value of the product.

Some Considerations

The matter of poisoning the soil with industrial wastes found in digested sludge seems highly speculative, principally because it appears that any sterilizing material in such concentrations as to poison the soil would effectively inhibit digestion; and while soil damage might occur from such a source as raw sludge, it seems doubtful that the digested counterpart could ever do any damage. Soil poisoning, then, may be dismissed as a possibility because the use of raw sludge as a ground builder or as a fertilizer should be prohibited for reasons more important than that it may contain plant poisons.

The same reasoning may apply to the impairment of soil by additions of grease in digested sludge. The immense amounts of grease which are destroyed in the digestion tank and comparatively small residue in the sludge, leaves one with the feeling that ordinary applications of five to ten tons per acre cannot possibly put enough grease into the soil to damage it materially. As an example: Assuming digested sludge to contain from 7,000 ppm. of grease, (about 14 pounds per ton of sludge) there would not be in excess of 70 to 140 pounds of grease per acre per year, an amount which could have but little effect upon the soil when mixed with a layer of eight to twelve inches of earth.

Despite Dr. Rudolfs' assurance that there is no problem from a hygienic standpoint, there is—and it remains a ghost not easily laid. The Doctor recognizes this himself in paragraph four of his story when, after dismissing the hygienic aspect as no problem, he says that sludge "appears" to be safe for reasonable use and "appears" to be as safe as manures. Most Sanitary Engineers will agree completely with the Doctor—few indeed will venture to state positively that the vexing problem does not exist. It is probably correct and sufficient to say that the use of sludges, after precautionary processing with heat or digestion, is reasonably safe, but should be applied to vegetables which are to be eaten raw, with full knowledge of its composition by both producer and consumer of the vegetables.

SLIDE RULE FOR SEWAGE PLANT OPERATORS*

The triple-purpose slide rule shown here was devised for operators of sewage disposal plants—especially the smaller plants. In one setting it solves the calculation of % Solids Removed by sedimentation tanks, and also gives chlorine dosage from the daily pumpage and amount fed. It will be noted that the upper two logarithmic scales serve dual functions.

A superimposed scale gives Relative Stability at 37°C. corresponding to days storage as marked off on the scale labeled "Initial Solids." This strip (at top is intended to be cut off and glued inside the slideway of the rule.

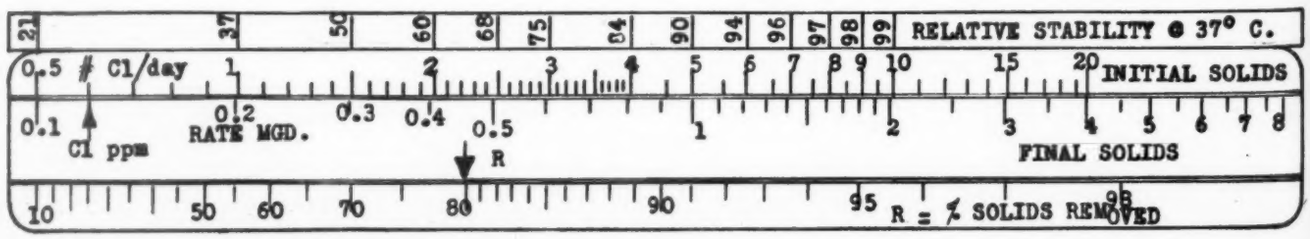
Calculation of % Solids Removed is as follows: Set the "Final Solids" figure (ml./L) on the slide exactly opposite the "Initial Solids" figure on the top stock; arrow (R) will then indicate % "Solids Removed" on the bottom scale.

To calculate chlorine dosage: Set the pumpage (M.G.D.) on the slide opposite the amount of chlorine fed (lbs./24 hr.) on the top scale; the arrow marked (Cl) points to the chlorine dosage (p.p.m.) on the top scale.

This rule can also be used very conveniently for figuring per cent removal of other quantities than solids, for instance B.O.D. removal, by employing the Solids scales, with an appropriate multiplier in order to locate the result on the bottom scale. Thus for B.O.D. improvement calculations the Initial B.O.D. divided by 100 is located on the top scale; under this point the final B.O.D., also divided by 100, is set on the slide; the arrow R then gives per cent B.O.D. removal directly on the bottom scale.

By virture of the simple logarithmic rulings on the Initial Solids and Final Solids scales, these two scales may also be used for ordinary multiplication and division. In this way activated sludge plants will find these scales handy in figuring the Sludge Index.

*Contributed by A. A. Hirsch, Instructor, State Dep't. of Education, Baton Rouge, La.



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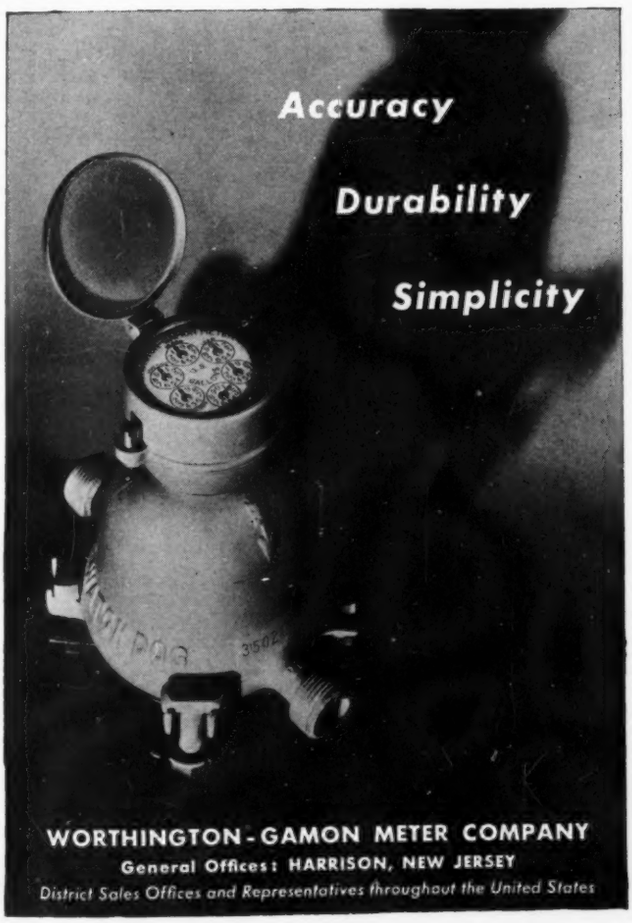

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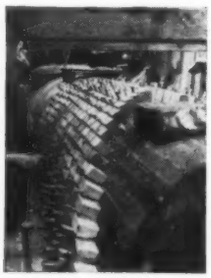

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MEETINGS SCHEDULED

April 20-22—SANTA CRUZ, CALIFORNIA
California Sewage Works Association. Secretary, Wm. T. Ingram, Stockton, Calif.

April 23-25—BALTIMORE, MD. (Lord Baltimore Hotel)
American Society of Civil Engineers. Spring Meeting. (Sessions of Sanitary Engineering Div. April 24, with afternoon inspection of Baltimore Treatment Works.) Secretary, George T. Seabury, 33 West 39th St., New York, N. Y.

April 24—BRIDGEPORT, CONN.
New England Water Works Association. Secretary, Frank J. Gifford, 613 Statler Building, Boston, Mass.

April 24-25—INDIANAPOLIS, IND. (Hotel Antlers)
Indiana Section A.W.W.A. Secretary, Herman G. Horstman, Sup't Water Distribution, Public Service Co. of Indiana, Traction Terminal Building, Indianapolis, Ind.

April 28-30—QUINCY, ILL. (Lincoln Douglas Hotel)
Illinois Section A.W.W.A. Secretary, H. E. Hudson, Jr., Experimental Filter Plant, 6843 Oglesby Ave., Chicago, Ill.

May 8-9—WASHINGTON, D. C. (Raleigh Hotel)
Maryland-Delaware Water & Sewerage Association. Secretary-Treasurer, Chesley F. Garland, 2411 N. Charles St., Baltimore, Md.

May 8-10—SEATTLE, WASH. (Olympic Hotel)
Pacific Northwest Section A.W.W.A. and
Pacific Northwest Sewage Works Association. Secretary, Fred Merryfield, Oregon State College, Corvallis, Ore.

May 12-14—CHARLESTON, S. C. (Fort Sumter Hotel)
Southeastern Section A.W.W.A. Sec'y-Treas., B. P. Rice, R. F. C. Healey Bldg., Atlanta, Ga.

May 15-16—CINCINNATI, OHIO (Gibson Hotel)
Ohio Section A.W.W.A. Secretary, T. R. Lathrop, State Department of Health, Columbus, Ohio.

May 22—BURLINGTON, N. J.
New Jersey Section A.W.W.A. (Luncheon and Inspection of Foundries of U. S. Pipe & Foundry and R. D. Wood Co.) Secretary, C. B. Tygert, Box 178, Newark, N. J.

May 23-24—MISSOULA, MONT. (Hotel Florence)
Montana Section A.W.W.A Sec'y-Treas., H. B. Foote, Director, Div. of Water and Sewage, State Board of Health, Helena, Mont.

May 26-28—SHEBOYGAN, WIS. (Grand Hotel)
Conference of Wisconsin Sewerage Works Operators. Sec'y-Treas., W. J. Golueke, Metropolitan Sewerage District, Green Bay, Wis.

June 22-26—TORONTO, ONT. (Royal York Hotel)
American Water Works Association. Annual Convention. Secretary, Harry E. Jordan, 22 E. 40th St., New York, N. Y.

June 22-26—TORONTO, ONT. (Royal York Hotel)
Canadian Section A.W.W.A. (Annual Meeting). Secretary, A. E. Berry, Ontario Department of Health, Parliament Building, Toronto, Ont. (Meeting Jointly with Annual Convention of A.W.W.A.)

Aug. 7-9—ERIE, PA.
Western Penna. Section A.W.W.A. Secretary, E. P. Johnson, 418 Flannery Bldg., Sta. 13, Pittsburgh, Pa.

Sept. 1-3—STATE COLLEGE, PA. (Pa. State College)
Pennsylvania Water Works Operators' Association. Sec'y Treas., I. M. Glace, 22 South 22nd Street, Harrisburg, Pa.

Sept. 3-5—STATE COLLEGE, PA. (Pa. State College)
Pennsylvania Sewage Works Association. Sec'y-Treas., Bernard S. Bush, Kirby Health Center, Wilkes-Barre, Pa.

Sept. 18-19—SANTE FE, NEW MEXICO (LaFonda Hotel)
Rocky Mountain Section A.W.W.A. Secretary, E. V. Howe, Sanitary Engineer, State Board of Health, Denver, Colo.

Sept. 23-26—BOSTON, MASS. (Hotel Statler)
New England Water Works Association (Annual Convention). Secretary, Frank J. Gifford, 613 Statler Building, Boston, Mass.

Sept. 24-26—GRAND RAPIDS, MICH. (Hotel Pantlind)
Michigan Section A.W.W.A. Secretary, Maurice N. Gerardy, Department of Water Supply, Detroit, Michigan.

Oct. 9-11—MINNEAPOLIS, MINN. (Nicollet Hotel)
Minnesota Section A.W.W.A. Secretary, R. M. Finch, Wallace & Tiernan Co., Inc., 416 Flour Exchange, Minneapolis, Minn.

Oct.—PROVIDENCE, R. I. (Hotel Biltmore)
New England Sewage Works Association. (Annual Fall Meeting.) Sec'y-Treas., LeRoy W. VanKleeck, State Dept. of Health, Hartford, Conn.

Oct. 13-16—FORT WORTH, TEXAS
Southwest Section A.W.W.A. Secretary, L. A. Quigley, Supt. City Water Works, Fort Worth, Texas.

Oct. 14-17—ATLANTIC CITY, N. J. (Convention Hall)
American Public Health Association (70th Annual Meeting). Executive-Secretary, Reginald M. Atwater, M.D., American Public Health Ass'n., 1790 Broadway, New York, N. Y.

Oct. 20-22—CEDAR RAPIDS, IOWA
Missouri Valley Section A.W.W.A. Secretary, Earl L. Waterman, Prof. of Sanitary Engineering, Univ. of Iowa, Iowa City, Ia.

Oct. 22-25—FRESNO, CALIF. (Hotel Fresno)
California Section A.W.W.A. Sec'y-Treas., G. E. Arnold, San Francisco Water Department, Millbrae, Calif.

Oct. 22-25—NEW ORLEANS, LA.
American Public Works Association. Ass't Director, N. Hebden, 1313 East 60th St., Chicago, Ill.

Oct. 27-29—NASHVILLE, TENN. (Andrew Jackson Hotel)
Kentucky-Tennessee SECTION A.W.W.A. Secretary, H. D. Schmidt, Director Div. of Sanitary Engineering, Department of Health, Nashville, Tenn.

Nov. 3-5—HIGH POINT, N. C. (Sheraton Hotel)
North Carolina Section A.W.W.A. and
North Carolina Sewage Works Association. Secretary, R. S. Phillips, Box 1170, Durham, N. C.

Nov. 6-7—BALTIMORE, MD.
Four States Section A.W.W.A. Secretary, Lloyd Nelson, U. S. Pipe and Foundry, Broad and Chestnut Streets, Philadelphia, Pa.

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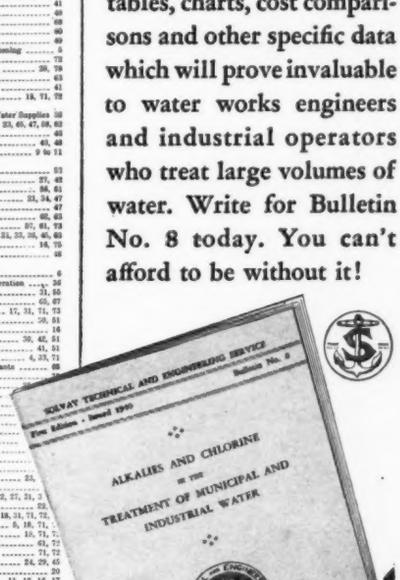
OF THIS VALUABLE REFERENCE BOOK?

Index

This comprehensive survey on water treatment has already become famous. Every water-treatment expert should have it at his fingertips. It describes briefly the various treating processes for water used for both municipal and industrial purposes.

FILLED WITH TABLES AND CHARTS

Bulletin No. 8 is filled with tables, charts, cost comparisons and other specific data which will prove invaluable to water works engineers and industrial operators who treat large volumes of water. Write for Bulletin No. 8 today. You can't afford to be without it!



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AERO - FILTER has won wide and favorable recognition in the sewage treatment field because of the many advantages it offers in achieving low cost treatment in plants of a wide range of capacities.

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LITERATURE AND CATALOGS

"Johns-Manville Products" are presented in a copiously illustrated catalog of 50 pages. Included are numerous products used now in water works and sewerage plants, including corrugated "Fransite" roofing, wall boards, flooring acoustical ceilings, conduit, pipe, packings, gasket materials, and pipe line coatings. It strikes us that this complete illustrated catalog should interest every designing engineer and utility manager. For a copy of "J-M Products" write Johns-Manville, 22 East 40th St., New York City.

The "Bellmaster"—a New Pipe Joint is announced by Dresser, the world's largest and oldest manufacturer of pipe joints, in a bulletin just off the press. This radically new flexible joint for bell and spigot C.I. pipes has many points of interest. First, it fits completely *into* the bell, with no protruding parts; as to simplicity, it consists of but three simple ring parts and six draw-up cap screws; as to advantages, it eliminates jute packing or yarn and exposes to the water only iron and rubber, thus avoiding the harboring place of bacteria; as to flexibility, it permits deflections at joints of as much as 8 degrees or 6 inches, and decreasing with size, but still 5 degrees on 16-inch pipes; as to labor saving, no bell-holes are required and joints may deflect as much as 5 degrees when the joint assembly is made with unskilled men and one simple ratchet wrench. The "Bellmaster" Joint consists of an inner ring and outer ring of malleable iron, between which is famed Dresser gasket of compounded rubber. The whole assembly slips *inside* of the bell and the 6 cap-screws pull the assembly together to squeeze the rubber gasket against the bell, and the spigot faces. Permissible deflection at joints in assembly and laying permits making of joints at trench top and lowering the line as trenching progresses, curved or straight, shallow or deep.

The "Bellmaster" bulletin tells a very complete story of this new bell joint, with its "3 main benefits plus 10 more proved advantages." For a copy write the Dresser Mfg. Co., Bradford, Pa.

"The Automatic Magnetite Filter" is presented in a new Dorrco Bulletin which tells the story of the Magnetite Filter in a splendid manner by word, detailed drawings, sketches and pictures of typical installations amongst the 44 units now serving 23 plants with a total design capacity of 300 mgd. New features of the automatic filter are emphasized, and its application to four different types of sewage treatment plants are illustrated in strip flowsheets covering plain sedimentation, chemical precipitation, trickling filter treatment and activated sludge process. Another set of sketches shows the various ways in which this filter may be installed, either in a separate structure, or in combination with a mechanical flocculator, mechanical clarifier or a combination of flocculator and clarifier. There is also a page of operating data containing performance figures from six different installations. For a copy of "The Automatic Magnetite Filter," manufactured by Filtration Equipment Co., 10 E. 40th St., New York City, and marketed by The Dorr Co., 570 Lexington Ave., New York City—write either company.

"Anhydrous Ammonia" is the subject of a new Mathieson hand-book of 16 pages in the convenient 6x9 inch size which is devoted to Anhydrous Ammonia. Some of the subjects covered in detail are the

chemical and physical properties of liquid anhydrous ammonia, including curves on pressure and temperature relations, density of liquid ammonia and solubility of ammonia in water; ammonia containers and their safe handling; withdrawing ammonia from containers and from the system; piping and valves; ammonia leaks; physiological effects of ammonia; and first aid measures in case of serious injury or exposure. Copies of this new and useful Mathieson booklet are available upon request to the Mathieson Alkali Works, 60 E. 42nd St., New York, N. Y.

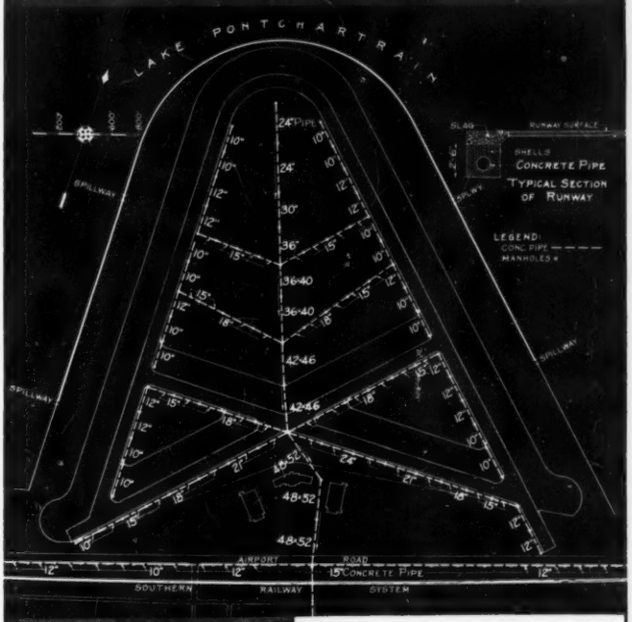
"Flexo-Pac" Jointing is the year-old rubber yarn substitute for making poured bell and spigot joints. It is described and its advantages, as the jointing material of 1941, are cited in a set of leaflets from The Eclat Rubber Co. of Akron, Ohio. "Flexo-Pac" (introduced under the name "Sani-pac") was developed by Hayes Kuhn's, of the Leadite Co., who had long appreciated the need for a packing material free of "bug-breeding" characteristics. The Eclat leaflets claim that this sanitary and easy-to-work-with jointing material costs practically the same as any good grade yarning material. It presents a sketch and tables showing the weights and footage per coil of sizes for various pipes, and gives directions for its proper use. A group of testimonial letters from users of importance tell why repeat orders are placed. For further information ask for "Flexo-Pac" literature and samples. Address the manufacturer (per Kuhn's specifications), The Eclat Rubber Co., Akron, Ohio.

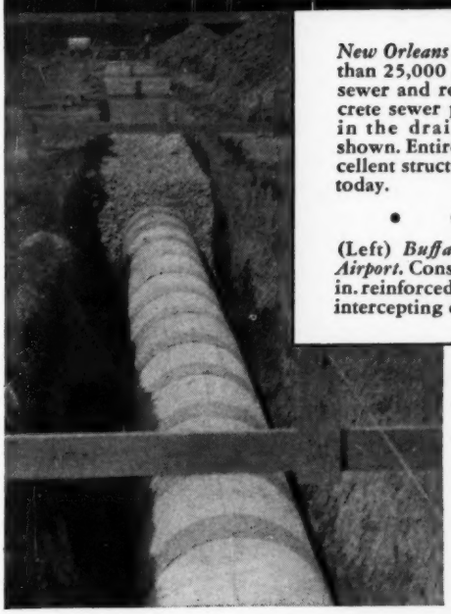
"Damping Out Meter Pulsations" is the caption of an informative illustrated article coming from Cochrane of Philadelphia. The story written by Wm. Melas, in charge of Cochrane's Instrument Engineering Section, tells how the use of simple expansion and compression air chambers, or riser pipes, can be connected into the line on suction or discharge side of pulsation creating pumps, and results in damping out those objectionable surges and impulses which cause meter registers and recording pins to swing so as to create an ink band rather than a line record. Another scheme, involving a pair of simple "throttling orifices" across the pipe line, has been found to correct pulsations in air, gas and steam lines. Helpful line drawings of each arrangement suggested in themseves tell the story. For a copy of "Measuring Pulsating Flow" write Cochrane Corpn., Allegheny Ave. and 17th St., Philadelphia, Pa.

"Ferri-Floc," the Conditioner, is the subject of a pamphlet from the Tennessee Corporation of Atlanta, Ga., and Lockland, Ohio, which describes the material (a modified ferric sulphate) and the simplicity of its use as a conditioner for sewage sludge in vacuum filtration. A line drawing simplifies the story and saves many words and a recital of results with it in a large plant indicates a resultant saving in chemical costs amounting to an appreciable figure. It concerned with sludge conditioning for either vacuum filtration or speeding up denaturing on sand beds, the "Ferri-Floc" pamphlet is of interest. For a copy write the Tennessee Corpn., Atlanta, Ga.

"Eight Years of Bitumastic Lining" is told in a story featured in "Bitumastic Bulletin No. 5." It reveals results of carefully made flow tests on a 10-mile long supply main of "Bitumastic" coated 30 in. steel pipes Dresser jointed. After 8 years of service the test indicated coefficients from 145.5 to 151 whereas the original tests 8 years ago revealed a value averaging 145.8 by the H.&W. formula. For a copy of "Bitumastic Bulletin No. 5," write Wailes, Dove-Hermiston Corpn., Westfield, N. J.

For Airport Drainage Jobs—
play safe with
CONCRETE PIPE





New Orleans Airport. More than 25,000 ft. of concrete sewer and reinforced concrete sewer pipe was used in the drainage system shown. Entire system in excellent structural condition today.

• • •

(Left) *Buffalo Municipal Airport.* Constructing a 36-in. reinforced concrete pipe intercepting drain.

MODERN airports must be properly drained. The ideal procedure is to design and build the complete drainage system as an integral part of the airport development.

At New Orleans Airport the drainage construction is *concrete pipe throughout. Concrete fully meets* ALL *the requirements of low first cost, structural safety, durability and maximum hydraulic capacity.*

Concrete pipe has been used to drain many of the country's leading airports. Write for literature on use of concrete pipe and reinforced concrete for your drainage or sewerage problem.

PORTLAND CEMENT ASSOCIATION
Dept. A4-29, 33 W. Grand Ave., Chicago, Ill.
A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

If you think all Packings are alike . . . Test *PALCO *and note the difference***

Yes, we agree that all packings look more or less alike from the outside. So how can you tell a superior packing from an ordinary one? The best way is by actual test—that's the way many other engineers have proved to their own satisfaction that PALCO is superior.

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EQUIPMENT NEWS

And Now—Hydraulic Pump Couplings

Providing Speed Variation at Maximum Power Economy

● One hears much these days about hydromatic transmission and fluid-drive in modern automobiles. Now this same principle of speed control in power transmission, from constant speed electric motors to centrifugal pumps, is available.

A means of obtaining pump delivery on a "sliding scale" and maintenance of constant pressures on systems through pump speed variation, with but a fractional sacrifice of power economy that usually results from pump throttling, constitutes a development of marked interest and importance in water works practices.

Likewise in sewage pumping, where treatment is practiced, there is an advantage in maintaining pump operation at rates approximating sewage flow to the station; also, in varying air output from blowers, and in regulating the rates of sludge return in activated sludge plants, an effluent recirculation in the high-rate filtration process. Therefore, hydraulic vari-speed transmission fits into the practice of sewage pumping and air-blowing in addition to water pumping.

In water pumping, when two centrifugals are connected in series, to provide 1st and 2nd stage lift, an economy in size of the new hydraulic couplings and a lower power loss resulting from the arrangement, can be obtained by locating the coupling between the two pumps—a method developed and patented by the De Laval Steam Turbine Co.

Space to describe the hydraulic coupling adequately is not available here; but, in brief, two impellers face each other in a housing filled with oil of suitable viscosity. The distance separating the two impellers determines the differential in speed of that connected to the drive motor shaft and the facing impeller connected to the pump shaft. In short, there is no physical connection between motor and pump, the speed of the driven pump shaft impeller being a function of the slippage maintained between it and the driving (motor) impeller. Such slippage is varied by the degree of separation of the facing impellers.

If the reader wishes an interesting story or the possibilities, and actual operating experiences with the new Hydraulic Pump Coupling for pump speed variation in pressure or delivery control, such is covered in a pamphlet captioned "Adjusting Centrifugal Pump Speed Cuts Operating Costs." This pamphlet may be had by a request to the De Laval Steam Turbine Co., Trenton, N. J.

Pennsylvania Salt Offers Neat Mixing Tank for Perchloron

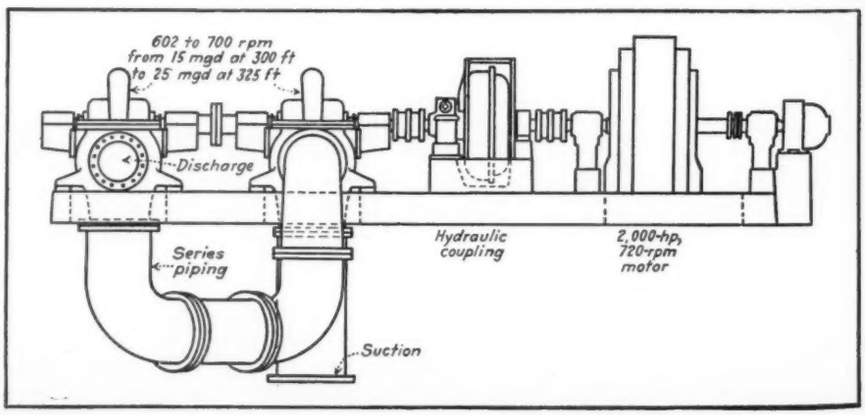
● Pennsylvania Salt Mfg. Company of Philadelphia has recently developed the neatly designed rubber-lined Perchloron Mixing Tank here illustrated.

"Perchloron" is Pennsylvania Salt's high test hypochlorite, which comes in cartons and drums as a free flowing powder employed in water, sewage and swimming pool treatment, generally in solution form. The new mixing tank is being offered to users of "Perchloron" as a piece of equipment which markedly simplifies solution preparation. We understand that its sale, however, is not to be in any manner restricted to users of "Perchloron" and is available to anyone for use in the preparation of solutions of any other material.

The accompanying illustration shows one of these tanks set up. The rubber-lined drum has a capacity of 55 gallons. There are two outlets in the tank. The one on the side is 5 inches from the bottom and is placed at this point in order to be above the level of the sludge which collects in the bottom of the tank as successive batches of solution are prepared.

After a batch of solution has been made up and allowed to settle, it may

(*Continued next page*)



be drawn off from the side outlet by unhooking and lowering the long rubber hose attached to the outlet. Either draw off all the solution into a stoneware crock, or draw it off as needed. The former procedure leaves the Mixing Tank available for preparing a new batch of solution.

After a number of batches has been made up the level of the sludge volume in the bottom of the tank will approach the solution outlet.

To remove this sludge, simply unhook the hose leading from the sludge outlet and drain in the bottom of the tank and run the contents to waste, thereafter rinsing down wih a hose stream.

The following specifications include further details of this neatly fabricated and handily transportable unit.

Specifications: Drum — 18 gauge steel, 34½" high, 22½" outside diameter, 55 gallon capacity. Placed on stand, bottom of drum is 14" from floor. Total weight of stand and empty drum is 93 pounds.

This information has been taken from a new "Perchloron" Hand-book which contains much pertinent information concerning this hypochlorite and its applications. A copy may be had by writing Pennsylvania Salt Mfg. Company, 1000 Widener Building, Philadelphia, Pa.

Improved High-Pressure Packing

• A high-pressure spiral packing is now available with the outer layer impregnated with lubricant forced into the packing by a special hot pressure process. The lubricant used is genuine palmetto graphite grease, which

(*Continued next page*)

France, Germany, Belgium, Holland and other countries where foodstuffs are not too plentiful and soil is overworked, have for years utilized their sewage sludge. France developed its use to a high degree. In Germany, it is a valuable product. Municipalities here in America are awakening to the fallacy of wasting and destroying sewage sludge by incineration, burial or dumping and incurring an added expense for such disposal.

Many cities now use one of the twelve models of Royer Sewage Sludge Disintegrators to quickly convert sludge cake into a readily marketed product. Sludge shovelled into its hopper is shredded to pea size, mixed, aerated and further dried, making it ideal for use as lawn top dressing and as a soil builder for plants and shrubs in general.

The Royer also thoroughly mixes in lime, phosphate, ammonium sulphate and other sweetening and enrichening materials in any properties desired.

Properly treated sludge finds a ready market among florists, truck gardeners, parks, cemeteries, golf courses and others. A portfolio of authentic information on the subject is yours for the asking.

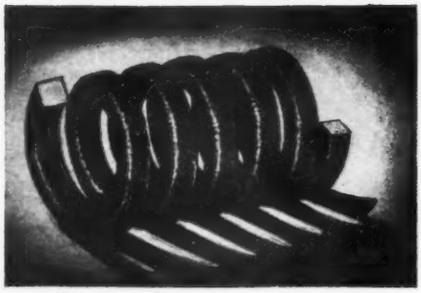
THE ROYER

ROYER FOUNDRY & MACHINE CO.
170 PRINGLE ST., KINGSTON, PA.

has proven outstandingly successful in the well-known PALMETTO braided packing.

Palmetto High-Pressure Spiral Packing is made of closely woven asbestos cloth with center block laid up against a flat strip of heat-resisting, resilient red rubber. The cover or wear face is firmly bonded to the center to make a strong square cornered packing. The packing is spiraled on a mandrel and vulcanized so that it retains its shape. Thereafter the exclusive lubricating process is applied.

The resulting construction combines ruggedness and resilience, which withstands mis-alignments and impact shocks, while providing effective and



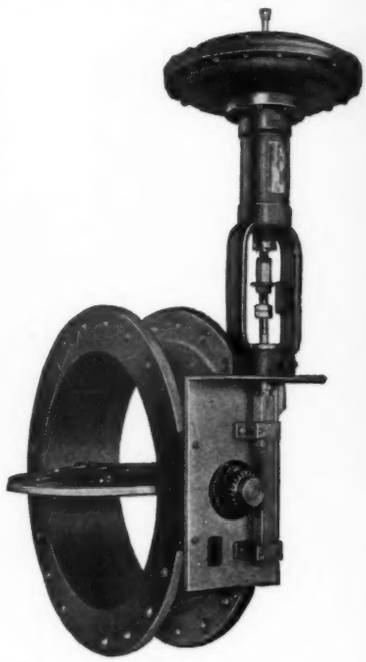
lasting lubrication.

Palmetto Spiral Asbestos Packing is specially adapted for reciprocating rods and plungers of steam engines and pumps, air and gas compressors, and various special machinery. For additional information write the manufacturer, Greene, Tweed & Company, 101 Park Avenue, New York City.

R.-S. Butterfly Valves

● Butterfly type valves for manual or automatic operation are offered by R.-S. Products Corporation of Philadelphia.

The features of the R.-S. butterfly Valve are its quick action, its light weight and self-cleansing design. The 77½ degree angle of closing results in an exceptional degree of tightness of closure for a butterfly valve.



This type of valve has come into wide use in the control of air, gas, steam and liquids, and are available in sizes of 2 to 48 inches for working pressures up to 15 lbs. They can be supplied for even higher pressures where desired.

A catalog recently issued by the manufacturer lists water and sewage works as users of R.-S. Butterfly Valves, which can be supplied for remote control through hydraulic or electric operation as well as manual handwheel, chain, or lever control. They are particularly useful as float-controlled units.

For further information and detailed specifications, request a copy of R.-S. Butterfly Valve Catalog 8 B from R.-S. Products Corp., Wayne Junction, Philadelphia, Pa.

New F-M Trash Type Pump

● Fairbanks, Morse & Co., has just announced a new line of "non-clogging" centrifugal pumps specifically designed for intermittent-duty sump or bilge pumping, wet-pit, or submerged service. Known as Fairbanks-Morse 5410SS submerged suspended sump and bilge pumps, the products are the most mod-

(*Continued next page*)

Reilly COAL TAR PRODUCTS

REILLY Pipe Coatings Are TIME-TESTED

● The best laboratory in which protective pipe coatings can be tested is "Mother Earth" herself. No other test can possibly be so positive and assuring—and it is from examinations of pipe, coated with REILLY PRIMER AND PIPE ENAMEL, and installed many years ago, that our claims for these products are made. The ability of REILLY coatings to stand up under various conditions of soil—and under wide extremes of temperature variation; has been amply proved.

Ease and convenience of application and comparative low cost are other considerations which are responsible for the constantly growing preference for these products. Write for literature.

61st ANNUAL MEETING AWWA TORONTO JUNE 22-26

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

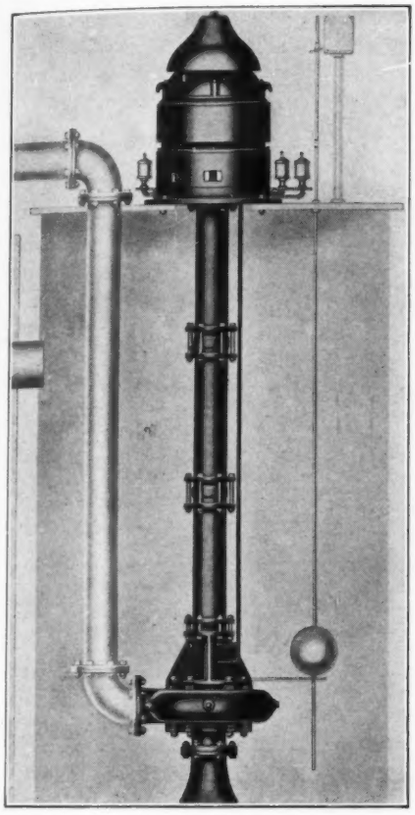
7513 S. DAMEN AVENUE, CHICAGO, ILLINOIS 500 FIFTH AVENUE, NEW YORK, N. Y. ST. LOUIS PARK, MINNEAPOLIS, MINN.

FIFTEEN · PLANTS · TO · SERVE · YOU

ern modification of the famous A.B. Wood design.

These pumps are available in 2, 3, 4, and 5-inch sizes for capacities up to 1400 g.p.m. for heads up to 120 feet and settings up to 25 feet. The pumps in the larger discharge sizes handle solids up to three inches in diameter without difficulty.

Construction features of this new line include a basic pump design developed around the well-known Fairbanks-Morse non-clog trash pump so successfully used since 1923 in municipal and sanitary sewage service; enclosed im-



peller with two well-rounded veins; motors of vertical, hollow-shaft, waterproof construction which employs the exclusive F-M copperspun rotor; high torsional-strength special steel shaft developed as a result of extensive F-M experience in the deep well turbine and propeller pump field; cast-iron volute free from all wearing rings such as used in water pumps; discharge openings that can be placed readily in any one of eight positions; and corrosion-resisting closure cover and closure seal which replace the stuffing box and adequately protect cast-bronze pump bearings.

An attractive fourteen-page bulletin, describing the complete line of 541OSS pumps, may be had by writing Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago.

New Process Control Unit by Permutit

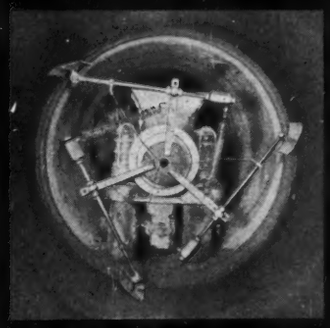
● The Permutit Company has recently announced the development of a new type of Recycling Control, which attached to meters functions to initiate automatic processes whenever a predetermined volume of water or other metered liquid has passed through the meter. It then resets itself and is ready to repeat the same service.

This control unit has its greatest application in the automatic washing, salt charging and rinsing cycles in the regeneration of zeolite softening units—thus eliminating manual attention on the human equation in softening operations. However, it is adaptable to the automatic control of batch processing of liquids in general—such, for instance, as the fill and draw process of water softening.

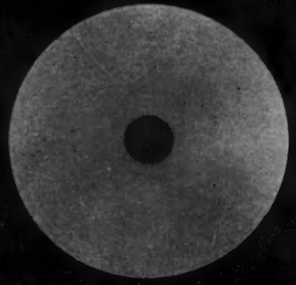
Particular points of interest in this new mechanism are that mercury switches are used throughout, insuring good electrical contact and freedom from dust and corrosion problems. There are no electrical current carrying parts on the dial. Adjustment of the quantity of water that will pass through the meter between automatic cycles is accomplished by means of an easily accessible dial visible through the glass face as are the totalizer, test hand and register dial.

For further details and illustrated literature, write the Permutit Co., 330 W. 42nd St., New York City.

Now— An Efficient and Economical Method of applying a Cement Lining to old water mains in place!



CENTRILINING 36" diameter pipe.



Cement lining in place. CENTRILINING is used to line new mains as well as to recondition old ones.

CENTRILINING is a simple—and certain—method of permanently increasing the carrying capacity of your water mains without resorting to constant cleaning—and without making major expenditures for new mains.

CENTRILINING consists of thoroughly cleaning the main *once*, and then applying by centrifugal force a dense lining of cement mortar, immediately troweled mechanically to a smooth finish. The resulting surface not only has an exceptionally high carrying capacity, but exceptionally long life.

This process is not untried, for many cities including *Newark, N. J.; Jersey City, N. J.; Cincinnati, Ohio; Boston, Massachusetts and Akron, Ohio,* have already restored the carrying capacity of old mains by the CENTRILINE PROCESS. In one city, where tests have been made, it was found that the coefficient "C" (Williams-Hazen) was raised 77% by the CENTRILINE PROCESS.

Further details of this process will be sent upon request.

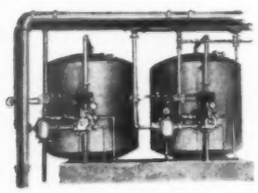
Centriline Corporation
140 Cedar Street New York, N. Y.

A Tale of Two Cities
and what they did about hardwater

LITTLE CITY

BICKNELL, IND.

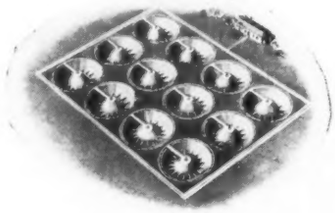
This progressive city decided to do something about the 24 grain hardness of its water. So it installed a Permutit* Automatic Zeolite Water Softening plant. Now the whole city enjoys soft, iron-free water. The equipment is compact and automatic, leaving operators free for other duties.



BIG CITY

MINNEAPOLIS, MINN.

Big cities need not put up with hard water, either. Minneapolis softens its 6-13 grain water by the Spaulding Precipitator Cold Lime Treatment. Twelve units of this new-type equipment installed at the Municipal Water Softening plant have a daily capacity of 120,000,000 gallons!



These examples illustrate the wide scope of Permutit Water Conditioning treatment. Let Permutit work with your engineers to solve *your* water problem. Write to The Permutit Company, Dept. G1, 330 West 42nd Street, New York, N. Y.

*Trade Mark Reg. U. S. Pat. Off.

PERMUTIT
WATER CONDITIONING HEADQUARTERS

BUILDERS *Kennison Nozzle* —for open flow

AN IDEAL METER FOR THE SMALL SEWAGE PLANT!

Simple, economical, accurate and trouble-free, the Kennison Nozzle measures raw sewage, sludge or effluent. Ask for Bulletin 308.

Among the 1940 *Kennison Nozzle installations is Monson State Hospital, Mass., illustrated. Bayard F. Snow, Engineer*

BUILDERS . PROVIDENCE
IRON FOUNDRY RHODE ISLAND

The "Chem-O-Cabinet" New Proportioneers' Product

● The new "Chem-O-Cabinet" recently announced by %Proportioneers%, Inc., is here pictured.

This new unit is a complete chemical feeder all ready for installation. A "See-Thru" type of chemical feeder is mounted on the trim steel cabinet. Removal of the hand door reveals a flexible reservoir. It is constructed of strong canvas completely coated for protection and flexibility with Du Pont's remarkable neoprene, which has qualities superior to pure gum rubber.

Inside of the cabinet, also, are a residual chlorine test kit and spare parts and accessories for readily converting the feeder for feeding various chemicals.

A feature is the ready portability of the complete unit for a variety of uses. For chlorination of water the proportioning feed pump has a capacity for 10 m.g.d. flow, or any other smaller flow, and against pressures up to 100 lbs. It is therefore especially recommended by the manufacturers for emergency usage or stand-by service.

For descriptive literature or further details, write %Proportioneers%, Inc., 9 Codding St., Providence, R. I.

WITH THE MANUFACTURERS

Pittsburgh Equitable Acquires National Meter Co.

Latter to Operate as National Division of Pittsburgh Meter

• Believing that the interests of the water works trade would be more adequately served by having one company making a complete line of all types and sizes of meters, the Directors of the Pittsburgh Equitable Meter Company of Pittsburgh, Pa., have purchased the assets of National Meter Company of Brooklyn, N. Y., thereby bringing together, under one management, the facilities of two of the country's oldest meter manufacturers. The National Meter plant will henceforth be operated as a division of the Pittsburgh Equitable Meter Co. This action was ratified by the stockholders of the National Meter Co. and the deal closed at a meeting of the principals held on March 17.

In their announcement, President W. F. Rockwell of the Pittsburgh Co., and President N. J. Kenny of National, call attention to the completeness of the line of meters which this purchase makes possible, since buyers can now select from the nine different types made by both companies. These include flat and conical nutating disc; oscillating, reciprocating and rotary piston; screw-propulsion; current and compound types. Every commercially manufactured type of liquid meter, they point out, is now represented in the complete Pittsburgh-National line.

Of interest is the fact that there is no overlapping between Pittsburgh products and those made by National. Structural differences and design features in meters identified by trade names, and popularized during the many years of separate operation of these two manufacturers, will be continued as the Pittsburgh-National line. Prompt deliveries of both new meters and parts for any of the existing types can be obtained from Pittsburgh Equitable or its National Division.

No change is contemplated in the personnel. The same salesmen will continue to contact their customers in their respective territories. Additional District Office and Warehouse facilities with adequate inventories, should provide greater service and convenience for the trade. Manufacturing plants are located in Pittsburgh, Hopewell, N. J., Columbus, Ohio, Oakland, Calif., and Brooklyn.

History Behind These Companies

The National Meter Co. was founded in 1870 by John C. Kelley, known as the father of the water meter industry. Associated with Mr. Kelley from the beginning was Dr. Lewis H. Nash, the noted inventor, to whom were granted ninety-two patents on water meters. Included among these are the first frost feature, the first successful straight reading register and the first oil enclosed intermediate. For the past seventy-one years this firm has been manufacturing meters exclusively. Trade names of National line familiar to the water works trade include Empire, Crown, Nash, Gem, Empire-Compound.

The Pittsburgh Equitable Meter Co. was originally founded as the Pittsburgh Meter Co. in 1887 by the inventive genius, the late George Westinghouse. During these many years of successful operation there have been developed such well-known meters as the Arctic, Tropic, Keystone, Eureka and the most recent—the "Imo" precision meter for the smallest flows.

In commenting on plans for the future, President Rockwell points out that—

"Bringing together the engineering staffs and research laboratories of National and Pittsburgh, plus the benefits derived from Meter Fellowships at a

LOCK JOINT PIPE *for*
DENVER'S WATER SUPPLY SYSTEM

• Vitally dependent upon a constant supply of fresh water, Denver, Colorado has gone some 65 miles away to the west slope of the Rocky Mountains for a new source of water supply. This system supplements the original supply taken from the headwaters of the South Platte River.

Over 317,000 feet of Lock Joint Reinforced Concrete Pressure Pipe in sizes from 20″ to 90″ comprise the principal arteries of these two important systems.

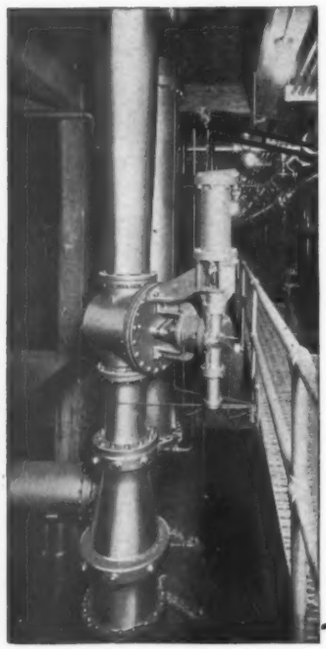
All of these Lock Joint Pipe Lines have been in constant and uninterrupted service since their installation, requiring virtually no maintenance or repairs. Recent flow tests made on 97,000 feet of 30″, 54″ and 60″ diameter lines showed values of "C"=147 (Williams-Hazen). Some of the lines tested had been in service for 9 and 18 years.

Denver's choice of Lock Joint Reinforced Concrete Pressure Pipe has been more than justified by this proven record of Economy and Uniformity of Performance under rigid service requirements.

LOCK JOINT *Plain and Reinforced* CONCRETE PIPE
LOCK JOINT PIPE CO. Established 1905 AMPERE, N. J.

Which Primary Element?

VENTURI TUBE, FLUME, WEIR, ORIFICE, OR NOZZLE



The primary element for your metering application should be selected not arbitrarily but by the requirements to be fulfilled and by the economic considerations entering into the installation.

Sewage and sludge are often, though not always, measured by Venturi Tubes, Flumes, or Weirs.

Water may be satisfactorily measured by any type of primary element. Factors such as the cost of pumping, the pressure and the size of pipe or channel usually dictate the device used.

Steam is usually measured by the Bailey Orifice or Flow Nozzle.

Bailey Meter Company holds no brief for any particular primary element, its only interest is in making sure that the user secures the highest accuracy and reliability at the lowest expense.

Detailed information on the advantages of various types of primary elements furnished on request.

MU-18

BAILEY METER COMPANY
1072 IVANHOE RD., CLEVELAND, O.
Bailey Meter Company Limited, Montreal, Canada

SAND FILTER CLEANING MADE EASY

A simple but effective method of cleaning sand filters with ESOTOO*—tested and proved successful in actual operation—is fully explained in new bulletin "A Method of Cleaning Filter Beds with Sulfur Dioxide."

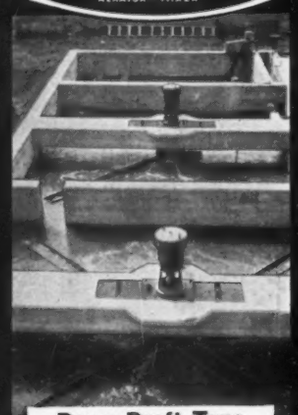
Isn't it worth your consideration? Write today.

V VIRGINIA

*"ESOTOO" is Virginia's Trade Name for Liquid Sulfur Dioxide.

VIRGINIA SMELTING COMPANY
WEST NORFOLK, VIRGINIA

AER-O-MIX
AERATOR—MIXER



Down-Draft Type
MECHANICAL
SEWAGE AERATORS

Write for information on AER-O-MIX for your SEWAGE or WATER TREATMENT APPLICATION.

VOGT MFG. CO.
INCORPORATED
P. O. Box 1122 Louisville, Ky.

world renowned scientific institute, gives assurance to the water works trade that the technical developments of the future, be they designs, methods, or materials, will be found in the products of the Pittsburgh-National line."

Howard Stillwell Joins Activated Alum

● Howard Stillwell has recently joined the Activated Alum Corp., of Baltimore, Md., in the capacity of special sales engineer.

Howard Stillwell

In a past issue it was announced that Activated Alum Corp. has been appointed representatives of Tate Pipe Linings, Inc. More recently Mr. Stillwell has joined Activated and will travel his old territory introducing the Tate method of cleaning and applying cement linings to water mains in place.

Mr. Stillwell, a former City Engineer-Manager, for a number of years represented the Leadite Company in the Southeastern territory, later becoming associated with producers of asbestos-cement pipe. In consequence, he is well qualified by training and experience to introduce and prepare estimates on the Tate method of rejuvenating old mains, and presenting the merits of such from an engineering and economic point of view.

Johns-Manville Opens New Southern Office at Atlanta

● A new Southern office has been established by Johns-Manville to facilitate service to municipalities as well as the South's rapidly growing industry. The new district, with headquarters at Atlanta, will serve the states of Georgia, Tennessee, North Carolina, South Carolina, Florida, Alabama, and Mississippi.

Thos. J. Roberts

The new district is headed by Thomas J. Roberts, formerly assistant to T. K. Mial, J-M vice president in charge of industrial sales and product development. A graduate of Cornell University with a degree of Civil Engineer, Mr. Roberts has been connected with Johns-Manville since 1925.

George Beitzel Honored

• George B. Beitzel, Manager of Sales of the Pennsylvania Salt Manufacturing Company in charge of many of the Company's products, including laundry, metal cleaning, water purification, swimming pool sanitation, and other specialty products, has been elected President of the Sales Manager's Association of Philadelphia.

Mr. Beitzel has been connected with the Pennsylvania Salt Manufacturing Company for the past eleven years, and his selection for this honor will be heartily approved by all of his friends.

Calgon Opens Detroit Office

• Calgon, Inc., Pittsburgh, Pa., chemical engineers and manufacturers of sodium phosphates for industrial and domestic uses, announces the opening of a branch office in Detroit, Michigan. Mr. Robert Graf will be in charge of Calgon sales and service.

The new office will also serve as Michigan headquarters for the Hagan Corporation and The Buromin Company, parent and sister companies, respectively, of Calgon, Inc. Mr. Arthur R. Borden will manage Hagan, Hall Service and Buromin activities with respect to automatic combustion control and boiler-water conditioning application. Messrs. Borden and Graf will be assisted by Mr. W. H. Weitzel.

Calgon's new Michigan office is located at 2512 Book Bldg., Detroit.

Strube Promoted by Link-Belt

• Link-Belt Co. announces that Harry L. Strube has been appointed chief engineer of the company's eastern division, with headquarters at the Philadelphia plant.

Having begun his Link-Belt service in the engineering department of the company in 1910, Mr. Strube in 1934 became assistant chief engineer.

He succeeds Fred F. Waechter, who started his Link-Belt career in 1898 and only recently retired as chief engineer after 43 years of service.

· SCHRAMM ·
AIR
COMPRESSORS

105 c. f. m. actual air delivery compressor — Streamline tool boxes. Easily transported from job to job.

THE MODERN TOOL FOR EVERY WATER AND SEWER DEPARTMENT

1 PAVING BREAKING: The SCHRAMM 105 compressor, illustrated will operate two of the heavy duty type paving breakers, breaks up concrete, asphalt or other tough material.

2 CLAY SPADE OR TRENCH DIGGER: For emergency work where speed is an essential factor, the trailer type SCHRAMM compressor can be quickly hauled right up to the job.

3 ROCK DRILLING: A very essential part of all excavating work can be just as easily handled with this compressor regardless of depth requirements. For light drilling this compressor will operate two of our model H-66 drills.

4 SHEET PILE DRIVING: So necessary to operators where materials have a tendency to slide. Again the 105' SCHRAMM compressor is recommended for handling two breakers with a sheeting driver attachment.

5 CAULKING PIPE JOINTS: The SCHRAMM 105 compressor ready at a moment's notice to repair breaks in pipe line. Ample air supply to operate gate closing mechanism when an emergency arises.

6 BACKFILL TAMPING: Is now a part of most specifications where pavement is to be laid over the fill because ramming is solid, even and tight.

SCHRAMM Portable Compressors are built in sizes ranging from 20 to 420 cu. ft., for gasoline or diesel engine drive—rubber tired, two wheel trailer type or for truck mounting. Write for bulletin No. 3900.

SCHRAMM, inc.
WEST CHESTER PA

HYDRO-TITE

ONE POUND does the work of four pounds of lead. Much easier to use than lead and requires no caulking.

HYDRO-TITE joints are strong, very flexible and tight.

Write for our free trial offer.

HYDRAULIC DEVELOPMENT CORPORATION
MAIN SALES OFFICE - 50 CHURCH STREET, NEW YORK
GENERAL OFFICES AND WORKS - WEST MEDFORD STATION BOSTON, MASS.
OVER 25 YEARS WITHOUT A FAILURE

IF Your SEWAGE effluents are high in suspended solids;

Or, you have a WATER PROBLEM;

Or, desire to RECOVER a product now wasted;

Or, you are disturbed by STREAM POLLUTION;

Or, are in any way interested in the removal of suspended solids from liquors;

You should investigate the

Laughlin Modified Rapid Sand Filter

BECAUSE, it is a simple automatic, continuous flow apparatus, designed on familiar lines, to accomplish a purpose without adding to the operator's troubles.

LAUGHLIN EQUIPMENT CORPORATION
270 Madison Ave., New York City

RUTHERFORD, N.J.

Weightometer Equipped with Weight Totalizer Load Indicator and Chart Recorder

Another outstanding sewage treatment plant adopts the MERRICK WEIGHTOMETER for actual determination of sewage sludge solids.

The WEIGHTOMETER automatically and continuously weighs the filter cake, indicates the rate of feed to the incinerator, continuously totalizes the tonnage, and, in addition, provides a permanent 24-hour chart record for use in checking the operating efficiency of the plant.

MERRICK SCALE MFG. CO.
PASSAIC, N. J.

F. M. Gardner Joins Cooper-Bessemer

● Furthering its territorial coverage of industrial and municipal power plant projects, The Cooper - Bessemer Corporation has recently announced the affiliation of F. M. Gardner with their diesel and gas engine sales department.

Mr. Gardner is a native of Portage, Wisconsin. At the age of sixteen he went to work with the Fairbanks-Morse Co., which company he served for 25 years. He then joined the Anderson Engine and Foundry Co., in the capacity of sales manager. He later became a special representative of the Ideal Electric & Manufacturing Company. Just prior to joining Cooper-Bessemer he held a similar position with the National Supply Co.

With his headquarters at the company's Mount Vernon, Ohio, offices, Mr. Gardner's territory will include western Ohio, Indiana, Kentucky, and Tennessee, where he will represent The Cooper-Bessemer Corporation in the sale of its stationary gas and Diesel engines for municipal and industrial projects.

Anderson Valve Corp. Opens New York Office

● Anderson Valve Corp., announce the opening of an office in New York City.

The main office of this company which manufactures all types of automatic control valves for water and sewage works is located in the Jones Law Building in Pittsburgh, the factory is at Scottdale, Pa., and the new office in New York is located at 295 Madison Avenue.

THE NATIONAL METHOD
BEFORE CLEANING
AFTER CLEANING

CLOGGED PIPES

Made Good as New

THE NATIONAL METHOD OF WATER MAIN CLEANING makes your old pipe practically as good as new. Every department is subject to loss through the ravages of time upon its distribution system. The cleaning out of this foreign matter inevitably leads to increased pressure and flow, improved health conditions, and lowered operating costs.

Our illustrated Booklet, "The Cleaning of Water Mains," will be sent upon request.

NATIONAL WATER MAIN CLEANING CO.
30 Church Street, New York, N. Y.

BRANCH ADDRESSES
205 West Wacker Drive, Chicago, Ill.
115 Peterboro St., Boston, Mass.
910 William Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Missouri
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Nebraska
501 Howard St., San Francisco, Calif.
2028 Union Ave., Montreal, Canada

ROUGH ON RUST!

The Rusta-Restor Method of Tank Protection

There's no percentage in letting rust accumulate on your water tanks and filter beds. **Get rid of it electrically**—and **stay** rid of it, **by electricity**—the only known means of POSITIVE PREVENTION:

RUSTA-RESTOR TRADE MARK REGISTERED
Circular on request

RUSTA RESTOR CORPORATION
1480 W. State St. Fremont, Ohio

CAST IRON PIPE

The Standard Material

for

Underground Mains

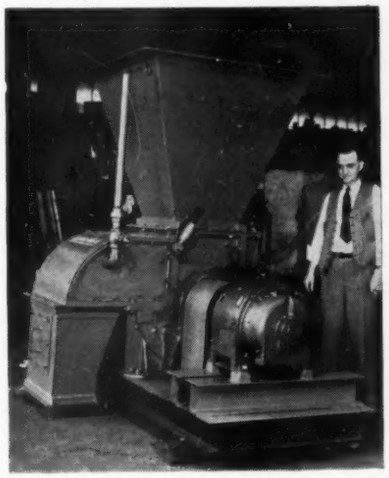
THE CAST IRON PIPE RESEARCH ASSOCIATION

Thomas F. Wolfe, Research Engineer
1015 Peoples Gas Bldg. Chicago, Ill.

GRUENDLER ESTABLISHED 1885

Here's a Shredder for your Sewage Plant

(Doing a Fine Job in Other Cities)



Sanitary Engineers will welcome the Gruendler feature—*No Choke Down.*

Embodies an outstanding patented feature which enables it to *handle rag stock* and similar materials *without choke down*, so as to pass through Screen Bar.

Write for Blue Print Specifications on our proved SHREDDERS, GARBAGE GRINDERS, FERTILIZER GRINDERS.

See Our Latest Equipment in the East Rutherford, N. J., Sewage Plant

"You Can't Buy a Better Grinder"

GRUENDLER
CRUSHER & PULVERIZER CO.
2920-28 N. Market St. St. Louis, Mo.

New Conceptions in Pump Sump Design

Announced by Peerless Pump

• Recent tests, which upset certain pre-conceived ideas of proper flow into propeller or mixed-flow pump suctions, are of interest and will no doubt result in rather general changes in propeller pump sump design.

The effect on the performance of propeller pumps when installed in sumps of restricted proportions, as compared with results in unrestricted sump areas is extremely interesting, according to evidence of tests recently presented by J. M. Hait, Chief Engineer of the Peerless Pump. Previous to these tests, it had been assumed that equalized flow conditions of a totally unconfined sump area would result in the most efficient operation of propeller pumps. But these tests conclusively revealed the error of such assumption.

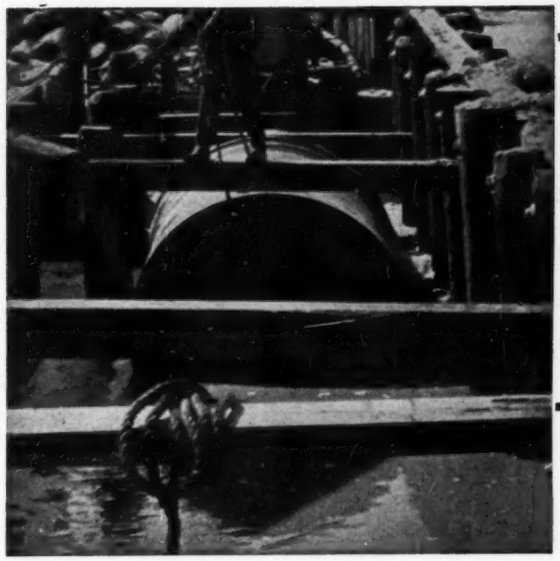
The question concerning the required sump sizes and dimensions into which propeller or mixed-flow pumps should be installed for most economical operation, is one of which little public data has heretofore been available. A series of comprehensive experiments, made under Mr. Hait's direction on the matter of propeller pump sump design, involved varying the distances from the pump suction to the sump floor, providing different side wall clearances, and flow arrangements restricted and unrestricted.

It was found that the axial and mixed-flow propeller pumps are more sensitive to the distribution of velocity at the inlet to the impeller than are centrifugal pumps of lower specific speeds. The objectives of these experiments were to determine the magnitude of the change in head and efficiency by different suction arrangements and to discover the least side and bottom clearance necessary if a reduction in head and efficiency is to be avoided.

It was found that the practical proportions for a propeller pump sump, from the standpoint of efficient operation, are such that the side-wall and the sump bottom clearances relative to the suction bell need not exceed one-half suction bell diameter. It was definitely proved that if the sump is installed in a large body of water without appreciable confinement, the operating head and efficiency will actually be *lower*.

Mr. Hait's investigation shows likewise that the best performance is obtained from a series of propeller pumps when installed at the end of a rectangular approach channel with sufficient length to the channel to insure uniformly distributed flow parallel to the channel walls without a swirling motion to the water when reaching the pump intake. The multiple pump installation thus should be such that each pump has its individual approach chan-

(*Continued next page*)



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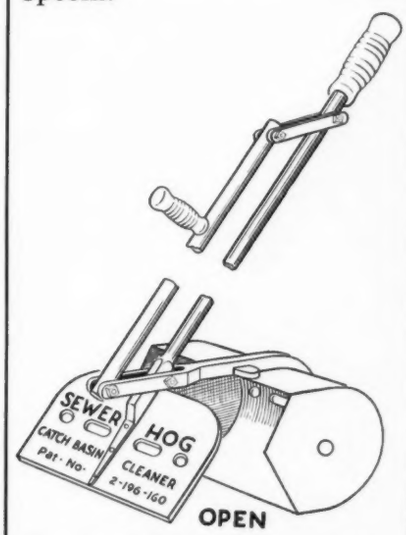

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Cochrane Enlarges Flow Meter Division

● Cochrane Corporation of Philadelphia announces the appointment of W. W. Tomes to head the Flow Meter Section, with W. C. Morrison as his assistant.

Mr. Tomes, a 1928 Purdue graduate, has wide experience in flow measurement and distribution work. Mr. Morrison attended the University of North Carolina and graduated from Brooklyn Polytechnic Inst. in 1936.

A-C Promotes Service Engineer Smith

● Carlton B. Smith, formerly district service engineer for Allis-Chalmers Mfg. Co. in the Southeast District, has been recently promoted to District Superintendent of Service, with headquarters in the Healy Bldg. in Atlanta.

Tulsa District Office of Pittsburgh Equitable Holds Annual Sales Conference

● During the week of January 6 the Pittsburgh Equitable Meter Company and Merco Nordstrom Valve Company salesmen in the Southwest gathered at the company's Tulsa plant for an intensive sales meeting. Many different subjects were covered pertaining not only to sales but also to engineering, according to A. J. Kerr, District Manager.

Captain A. E. Higgins, Vice President in Charge of Sales, and A. D. MacLean, Vice President and Chief Engineer, attended from the company headquarters in Pittsburgh. Similar conferences are now being held in other districts.

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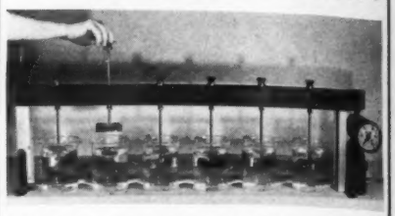
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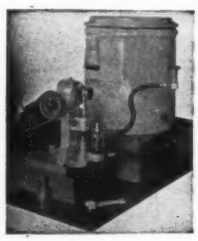
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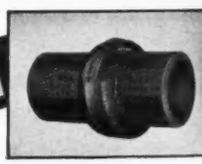
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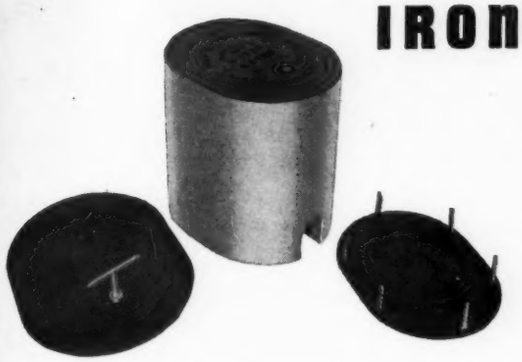

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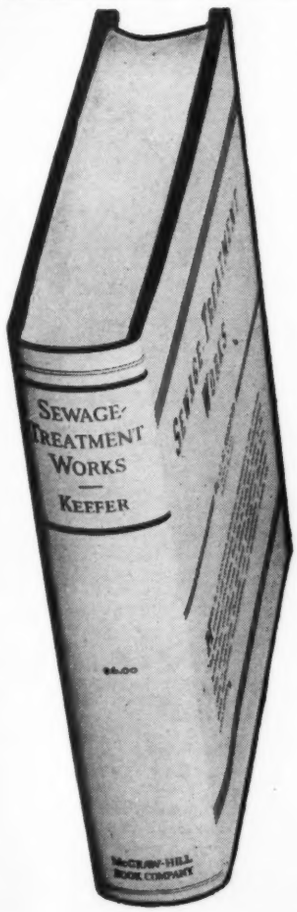

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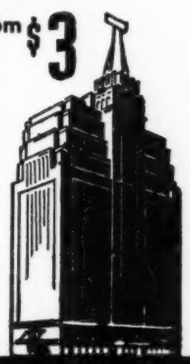
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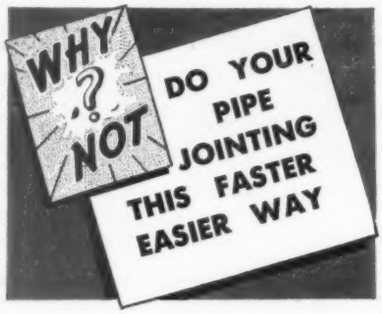

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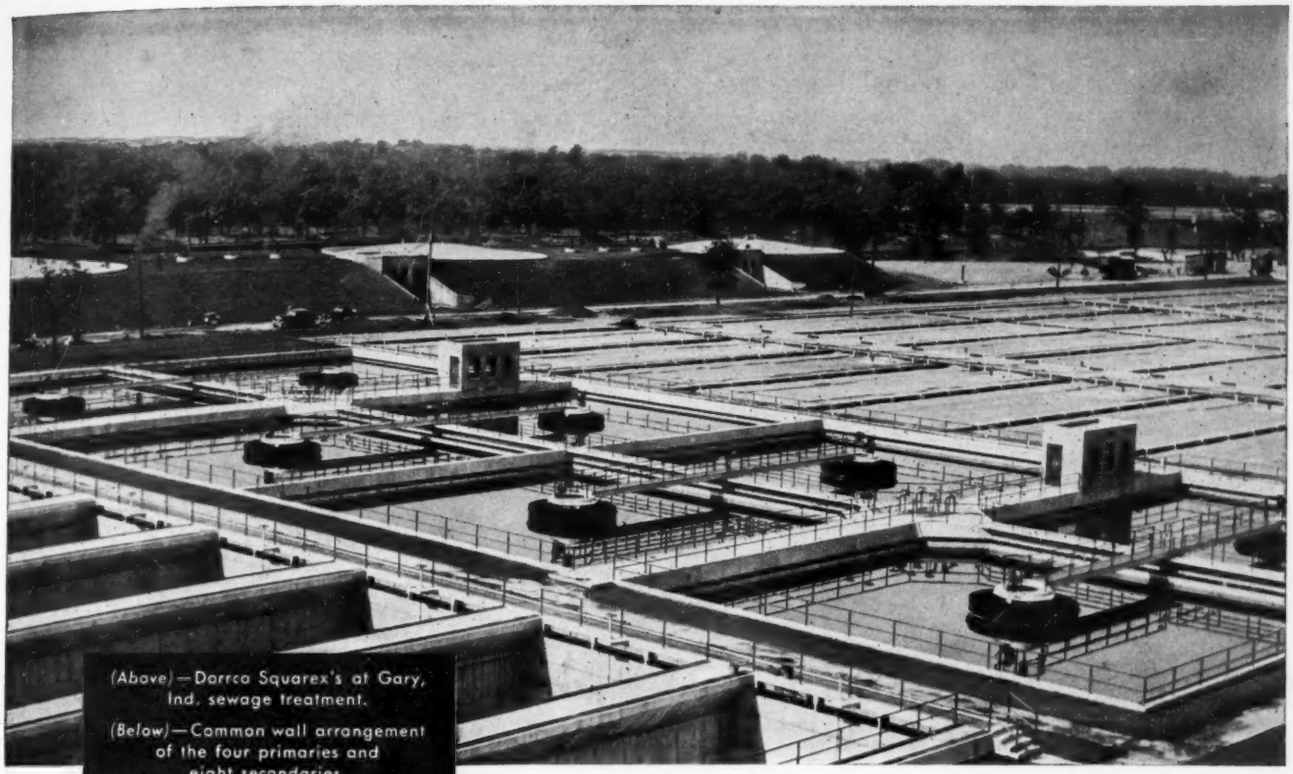
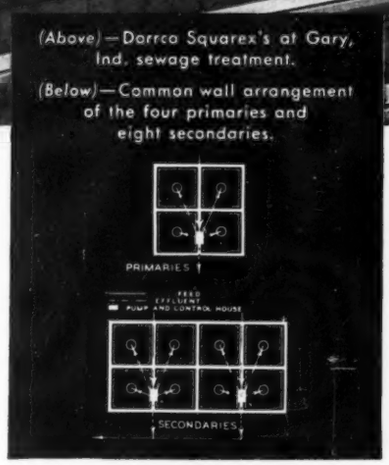


(Above)—Dorrco Squarex's at Gary, Ind. sewage treatment.

(Below)—Common wall arrangement of the four primaries and eight secondaries.



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The Dorrco Squarex Clarifier is the only mechanical clarifier adapted to installation in a square sedimentation basin. This fact permits symmetrical common wall construction for multiple unit installations.

Tank shape (a perfect square)—plus economical construction (common walls)—means a minimum weight and cost of clarifier mechanism per square foot of settling area—per cubic foot of detention volume.

Cost comparisons—multiple square tanks plus Dorrco Squarex's versus other tank shapes differently equipped—favor Dorrco Squarex Clarifiers. Other plus factors are an attractive symmetrical tank arrangement and a minimum of inter-connecting pipe lines and channels.

Our bulletin on Sedimentation, describes the Dorrco Squarex and its corner scraping blade, which assures every foot of area being scraped at each revolution. Write for your copy.

DORRCO

THE DORR COMPANY INC.

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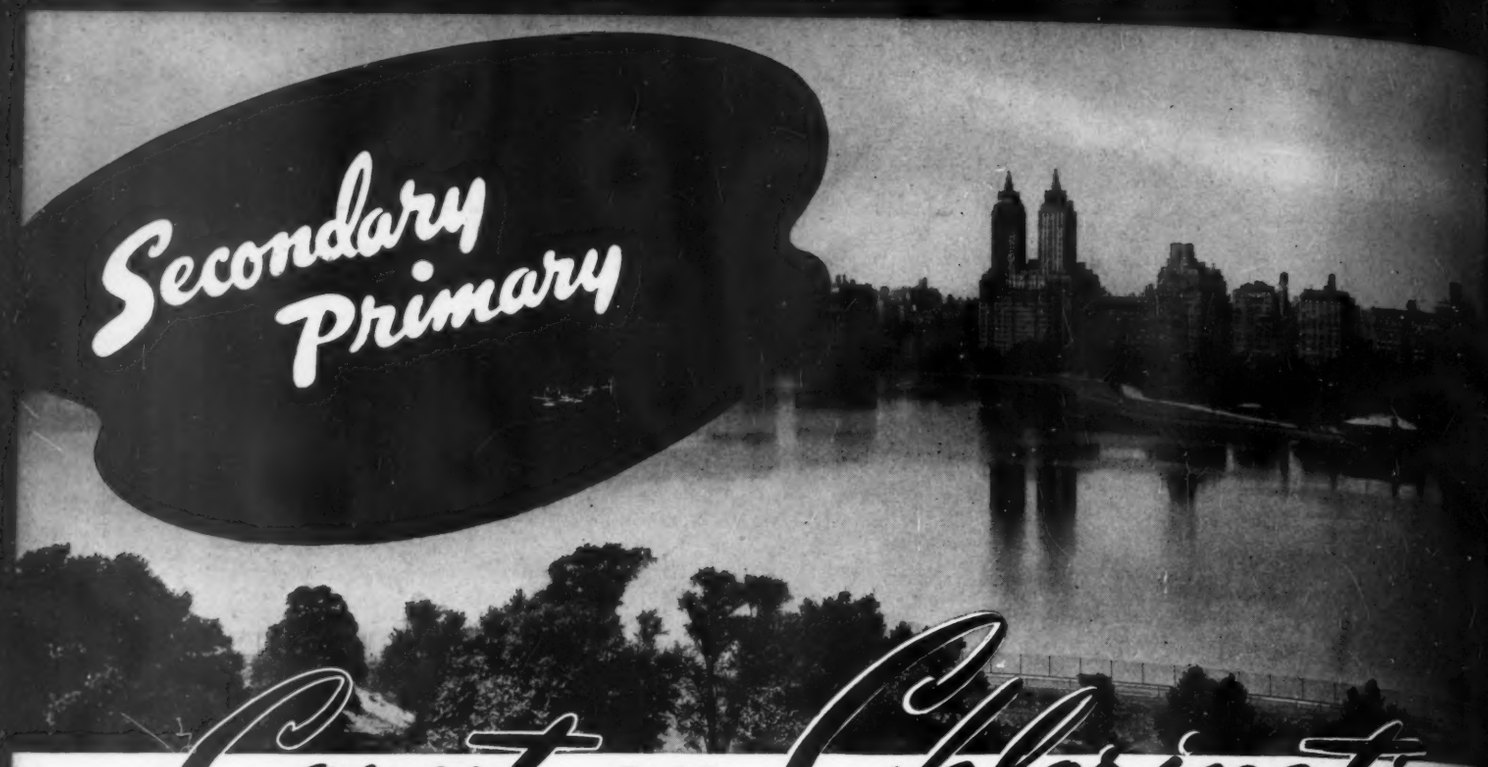

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...TO COUNTERACT POSSIBL POLLUTION OF DISTRIBUTION RESERVOIR —FLOATING RESERVOIRS

Home defense starts with health defense ... and health defense starts with protection of water supplies against every sort of emergency, accidental or deliberate. In particular, total protection under today's conditions demands that the threat of pollution of secondary storage reservoirs and other exposed points in the distribution system be counteracted in advance . . . And for this your primary defense weapon is chlorination.

Within the past few weeks, New York City has initiated a program for secondary chlorination of 100% of the outflow from all its open distribution reservoirs, using 14 of the latest type W&T Visible Vacuum Chlorinators. At Baltimor facilities for chlorinating outflow fro its six distribution reservoirs are nearin completion, also using W&T equipmen

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"The Only Safe Water is a Sterilized Water"

CHECK ON THESE 7 POINTS FOR TOTAL PROTECTION

- Secondary chlorination of floating reservoirs and other exposed points in the distribution system.
- Regular chlorination of supplies now untreated or treated only at intervals.
- Chlorinating equipment adequate to meet increased demand or emergency conditions promptly and without fail.
- Adequate provision for stand-by and duplicate units, in condition for immediate operation.
- Automatic means of recording chlorine dosage as a continuous check on performance.
- Treatment methods (such as ammonia-chlorine) permitting the maintenance of protective chlorine residuals throughout the distributions system without objectionable tastes.
- Portable or mobile chlorinating equipment, preferably self-powered, of a capacity adequate to cope with any local emergency.

WALLACE & TIERNAN CO., Inc.